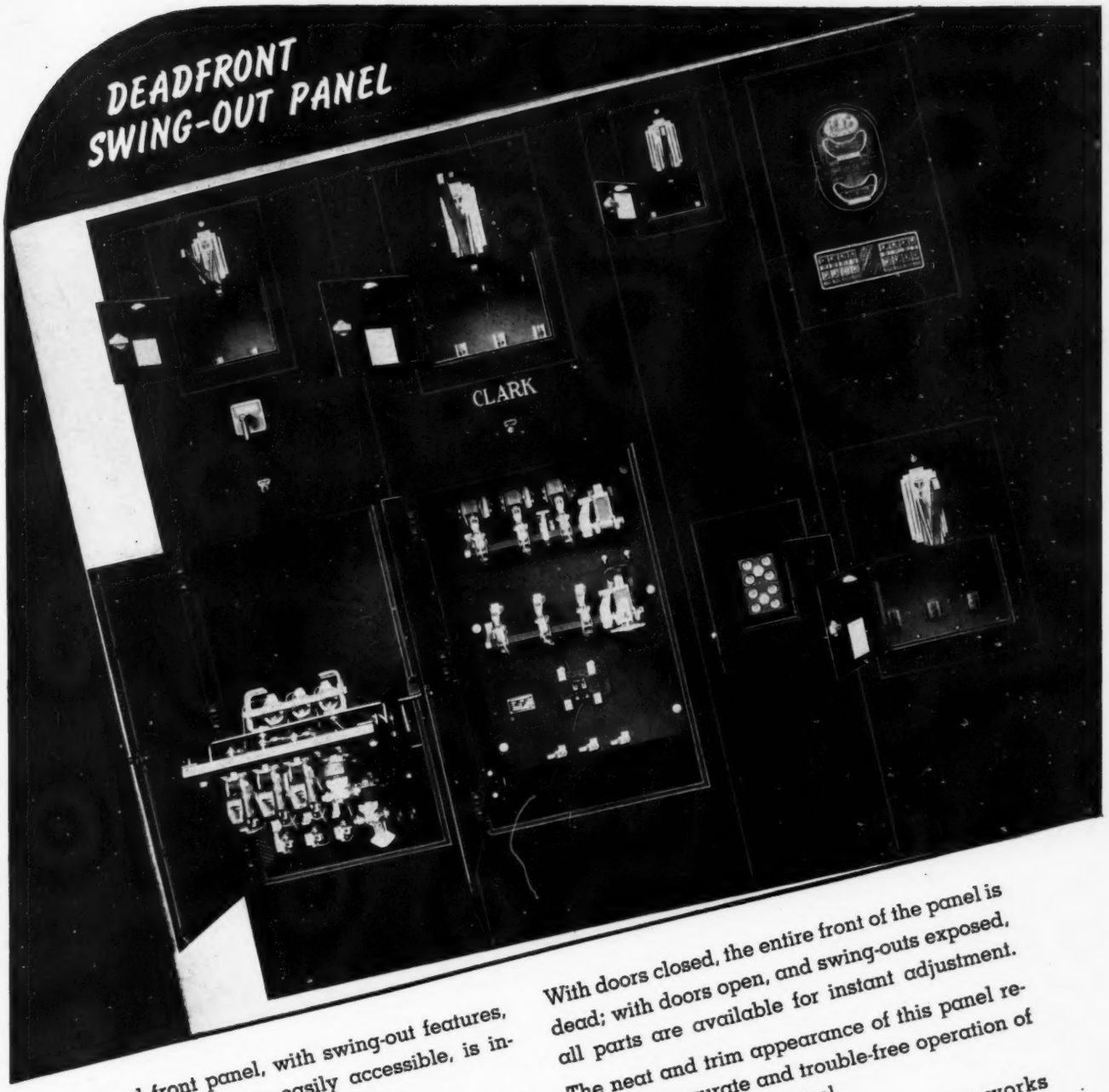
WATER WORKS & SEWERAGE

PERFORMANCE is a sales argument for cast iron pipe that speaks for itself from the records. Records of useful life bridging centuries. Records of maintenance costs that are well nigh negligible. Such is the heritage of U. S. pit cast pipe and U. S. Super-de Lavaud chill-free centrifugally cast pipe made under technical controls by processes vastly superior to those of olden times.
U. S. PIPE AND FOUNDRY COMPANY • General Offices: Burlington, N. J.
Plants and Sales Offices throughout the U. S. A.
Copyright, 1940 U. S. Pipe & Foundry Co.
U.S.
cast iron
PIPE



This dead front panel, with swing-out features, making all apparatus easily accessible, is installed in an Eastern Water Works.

It controls 1—30 H.P. and 1—50 H.P., 220 volt, 3 phase, 60 cycle, 3600 r.p.m. motors, which are operated by Telemeters.

In addition to the motor control equipment, this panel includes incoming line panel with metering equipment, and a lighting distribution panel.

With doors closed, the entire front of the panel is dead; with doors open, and swing-outs exposed, all parts are available for instant adjustment.

The neat and trim appearance of this panel reflects the accurate and trouble-free operation of the "3C" electrical control.

For all electric motor-driven water works and sewage pumping plants, Clark "3C" controls are available.

Our nearest office or agency will gladly consult with you.

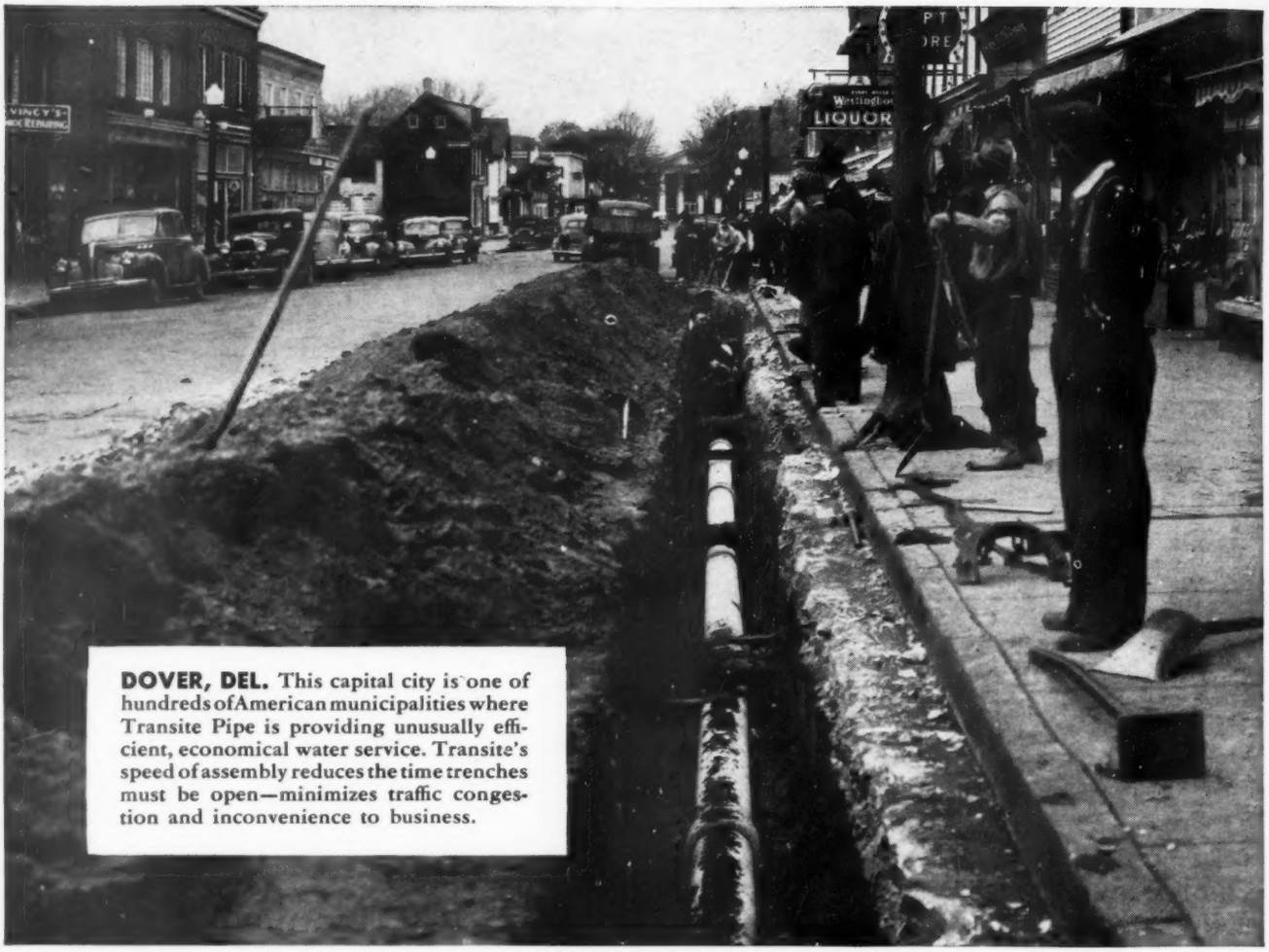
OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO

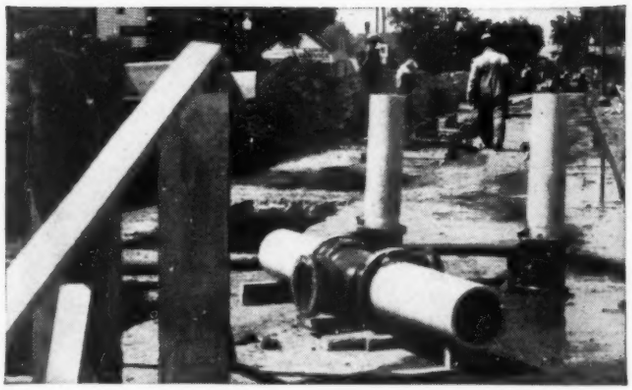
WATER WORKS & SEWERAGE, June, 1940. Volume 87. Number 6. Published monthly at 330 South Wells Street, Chicago, Ill., by the Gillette Publishing Company. Per copy, 25c. Subscription rate, United States and Canada, $2.00 per year; Foreign $3.00 per year. Copyright ,1940. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago ,Ill., under Act of March 3, 1879.

UNDER THESE CITY



DOVER, DEL. This capital city is one of hundreds of American municipalities where Transite Pipe is providing unusually efficient, economical water service. Transite's speed of assembly reduces the time trenches must be open—minimizes traffic congestion and inconvenience to business.

WICHITA FALLS, TEXAS. Transite, being non-metallic, can never tuberculate. As a result, delivery capacity (C-140) stays high throughout the system's long life . . . pumping costs remain permanently low.



GRAFTON, N. D. Whenever needed, short lengths of J-M Transite Pipe may be cut with an ordinary hand saw. Because of Transite's light weight, fittings can be assembled *outside* the trench and lowered into place.

JOHNS-MANVILLE PRODUCTS

JOHNS-MANVILLE

STREETS—

J-M Transite Pipe cuts the cost of water transportation, assures more efficient, lower-cost service throughout the years

Tuberculation Impossible! Because of Transite's asbestos-cement composition, its initial high flow coefficient of C=140 can never be reduced by tuberculation—delivery capacity stays high—pumping costs remain permanently low. In many cases smaller diameter pipe may be used—longer systems installed for the same appropriation—because it is not necessary to allow for steadily decreasing capacity due to tuberculation.

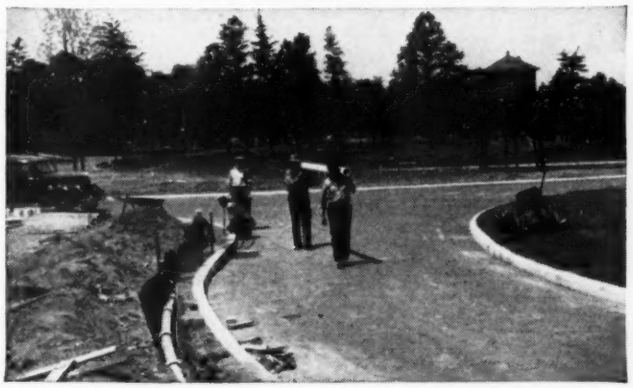
Maintenance No Problem! Uniformly strong and durable, Transite Pipe safely withstands earth loads and traffic pressure. It is highly resistant to all forms of corrosion . . . completely immune to electrolysis. And Simplex Couplings form tight joints that *stay* tight in service . . . virtually eliminate leakage.

Installation Costs Less! Transite's long, light 13-foot lengths are easy to handle . . . mean fewer joints in the line. And the Simplex Couplings used in Transite lines are assembled quickly, easily, even under difficult trench conditions. Furthermore, these flexible couplings need no large bell holes . . . permit the use of narrower, more economical trenches.

Before you start a new water line or extensions to your present system, you should have all the facts on how Transite Pipe can save you money. Send for brochure TR-11A. And if you're interested in more efficient, economical sewage disposal, ask for the Transite Sewer Pipe brochure TR-21A. Write Johns-Manville, 22 East 40th Street, New York, N. Y.

SAN DIEGO, CALIF. Flexible Simplex Couplings permit laying straight lengths of Transite around curves without special fittings. A deflection of 5° is possible at every joint.

DENISON, IOWA. Transite's dense, tough, asbestos-cement structure provides great durability and uniform strength . . . safely withstands the weight of heavy earth loads and soil stress . . . assures continued dependable water service and minimum maintenance through the years.



TOTOWA, N. J. The long 13-foot lengths, simple assembly method and relatively light weight of Transite Pipe cut handling and installation costs. No mechanical equipment is needed except on the largest sizes.

HAPEVILLE, GA. Made of asbestos and cement, Transite Pipe offers exceptional resistance to all forms of corrosion . . . is completely immune to electrolysis. Costly maintenance is seldom required.

TRANSITE PIPE

THE MODERN MATERIAL FOR WATER AND SEWER LINES

Indianapolis Installs Another ½ Million Gallon

ELEVATED TANK

THE 1,500,000-gal. tank shown above, together with a tank of identical capacity installed nine years ago, now serve an area in which nearly one-third of the population of Indianapolis reside. One of the problems which existed before the new tank was installed was the inability to furnish adequate pressure not only during mid-summer peak load periods, but also during normal consumption. The satisfactory experience of the Indianapolis Water Company in meeting the mid-summer peak load in an easterly district, served by the first 1,500,000-gal. tank led to their decision to solve the problem in the "Blue Ridge" district by installing another tank of equal capacity. Write for information.

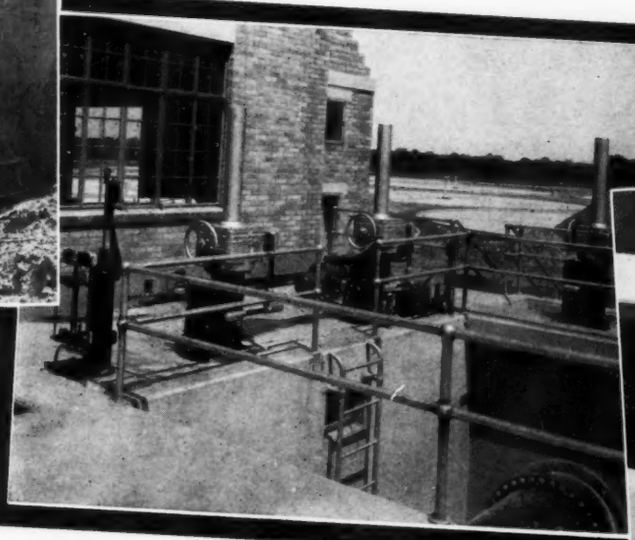
CHICAGO BRIDGE & IRON COMPANY

Chicago	2198 McCormick Bldg.	Birmingham	1586 North 50th Street	Philadelphia	1644-1700 Walnut St.
New York	3390-165 Broadway Bldg.	Tulsa	1646 Hunt Bldg.	Boston	1548 Consolidated Gas Bldg.
Cleveland	2262 Rockefeller Bldg.	Houston	2919 Main Street	San Francisco	1083 Rialto Bldg.
Dallas	1479 Liberty Bank Bldg.	Detroit	1551 Lafayette Bldg.	Los Angeles	1455 Wm. Fox Bldg.

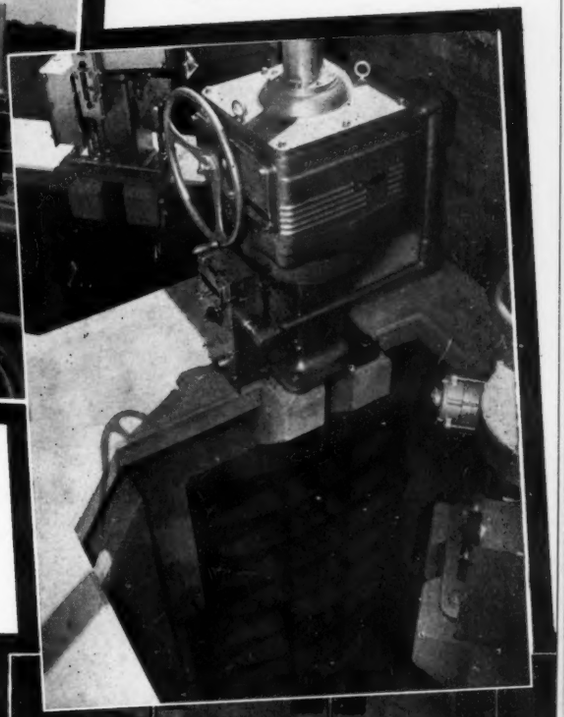
Plants at **BIRMINGHAM, CHICAGO, and GREENVILLE, PA.**
In Canada: **HORTON STEEL WORKS, LIMITED, FORT ERIE, ONTARIO**

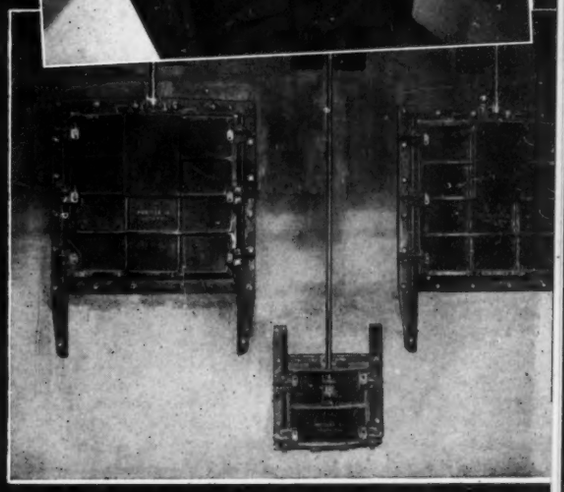
And now– AT DALLAS!

MUELLER-COLUMBIAN INSTALLATIONS



INSTALLATION VIEWS OF NEW DALLAS SEWAGE TREATMENT PLANT SHOWING MUELLER-COLUMBIAN SLUICE GATES, GATE VALVES AND OPERATING MECHANISMS.





Mueller-Columbian Equipment plays an important part in the smooth operation of the new Dallas Sewage Treatment Plant. Here you will find Mueller-Columbian Sluice Gates with Stainless Steel or Everdur Stems and Stainless Steel Trim. They range in size from 24" to 96"—some of them manually and some electrically operated. Here too, are installed many Mueller-Columbian Gate Valves with Stainless Steel Stems. The Valves range in size from 2" to 48", both manually operated and electrically operated.

Like many other outstanding plants, Dallas specified equipment that has the reputation for dependable, efficient and economical service—equipment that is correct in design and produced to exacting specification. Put your requirements up to Mueller Co. for counsel, specifications and quotation. Of course, there is no obligation.

MAIL

MUELLER CO.

CHATTANOOGA TENN.

Mueller Co., Dept. AB
Chatta., Tenn.
Kindly send me your new A-300 Catalog on Water Control Equipment.

Name _____

Address _____

City _____

VALUE

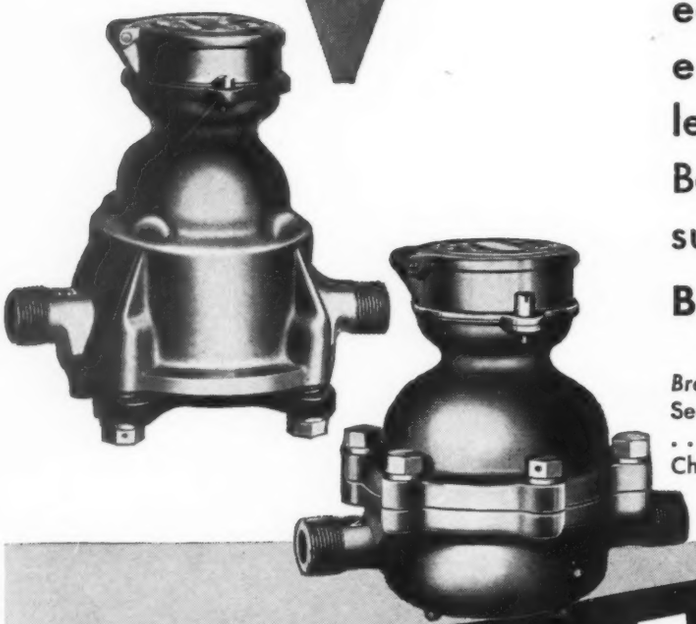
ACCURACY . . .

The Badger Meter Mfg. Company pioneered higher water meter accuracy standards.

Constant improvements in equipment have been made each year to maintain this leadership . . . In specifying Badger Meters you are assured of greater accuracy.

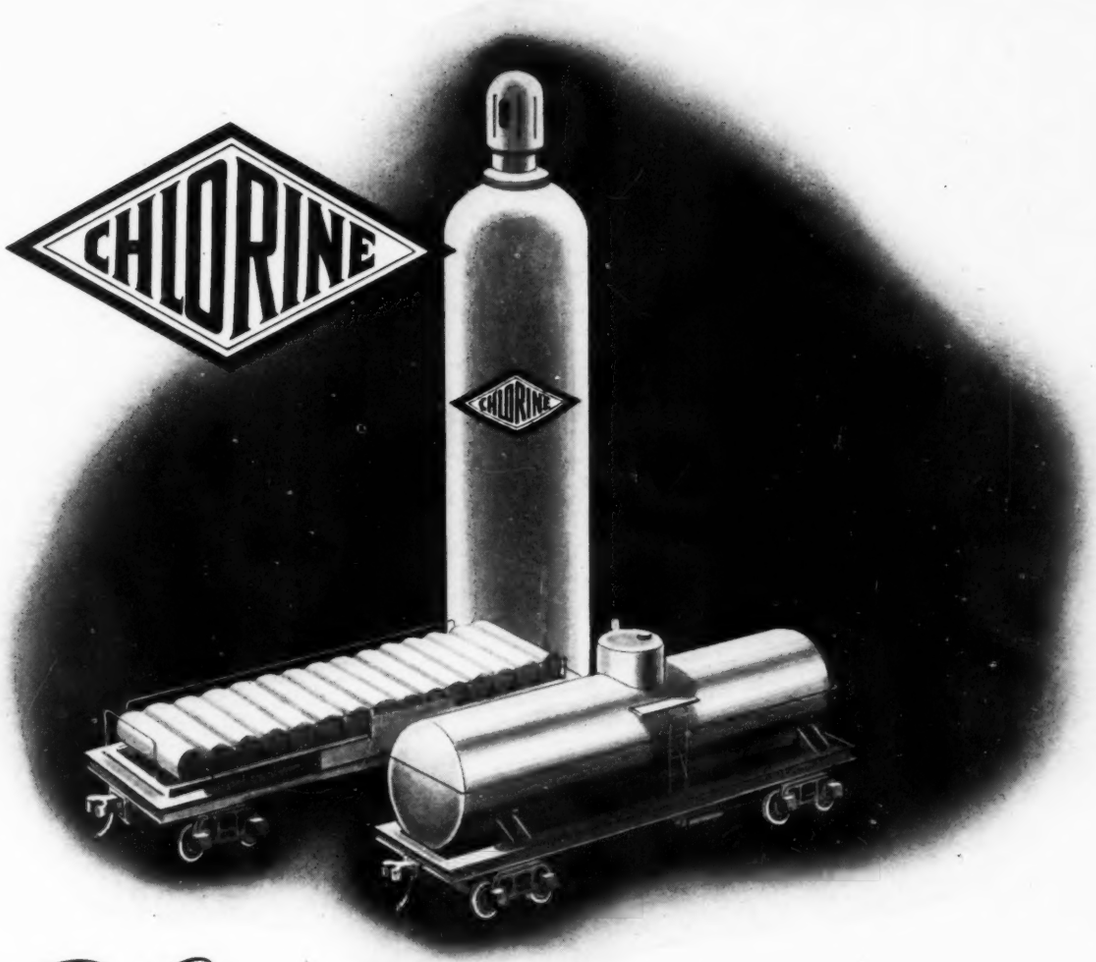
BADGER METER MFG. CO.
MILWAUKEE, WISCONSIN

Branch Offices: New York City . . . Tampa, Fla. . . . Seattle, Wash. . . . Savannah, Ga. . . . Kansas City, Mo. . . . Marshalltown, Iowa . . . Los Angeles, Calif. . . . Chicago, Ill. . . . Waco, Texas . . . Philadelphia, Pa.



DURABILITY
DEPENDABILITY
SENSITIVENESS
LOW COST MAINTENANCE

BADGER *Water* METERS



Regardless OF HOW YOU USE

DIAMOND LIQUID CHLORINE

DIAMOND ALWAYS COMBINES UNIFORM PURITY WITH MAXIMUM SAFETY AND CONVENIENCE IN HANDLING

DIAMOND plays no favorites! The one-cylinder user can count on the same uniformly pure, safely delivered Liquid Chlorine as can the largest tank car user! Years of sympathetic study of YOUR problems have evolved a technique in packaging, shipping and handling Diamond Liquid Chlorine that insures safe delivery in the type of container most convenient for your use.

DIAMOND ALKALI COMPANY • PITTSBURGH, PA., AND EVERYWHERE

15 MONTHS LATER

INDEX TO VOLUME XI

SEWAGE WORKS JOURNAL

VOL. XI NOVEMBER, 1939 No. 6

Special Articles

Incineration at Minneapolis—Schroepfer

Excerpts from conclusions of the final report prepared upon the completion of incinerator acceptance tests as printed in Sewage Works Journal, November 1939.

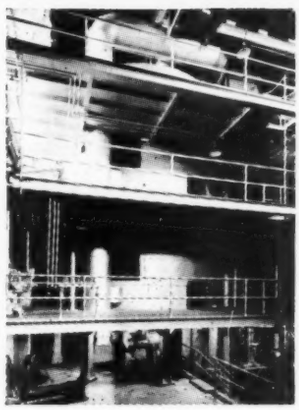
The incinerators are capable of incinerating the tonnage for which they were guaranteed, namely, 60 tons of dry solids per 24 hours for each incinerator. They have on occasion satisfactorily handled an overload of approximately 33 per cent.

The incinerators have complied with the provisions of the specifications relative to freedom from nuisances due to fly ash, odors and smoke. . . . The sludge was reduced to a clean ash, the combustible content averaging 1.6 per cent.

The requirements of the specifications relative to meeting certain guaranteed costs were fulfilled. The actual costs during the 90-day acceptance period were $4,559.68, or $0.455 per dry ton, as compared with the guaranteed costs as stated in the proposal of $7,084.04, or $0.707 per dry ton. Translating these costs to an annual basis the actual costs of incineration would be $18,492.03, as compared with the guaranteed costs of $28,729.71, or an annual saving of approximately $10,000 over the guaranteed costs.

THE ADVERTISEMENT BELOW WAS PRINTED IN JULY, 1938

Modern Sanitary Engineering in The "Twin Cities". . . . .



demanded sludge disposal by incineration.

The selection of Nichols Herreshoff furnaces to provide "the newest in mechanization . . . . . and incineration" is a tribute to the pioneering and experience of the Nichols Engineering & Research Corporation.

180 tons of dry sewage solids per day may be incinerated in the three 22'3" O. D. 8-Hearth Nichols Herreshoff units.

Whether the population is 900,000 or 9,000 there is Nichols Herreshoff furnace equipment to fit the load.

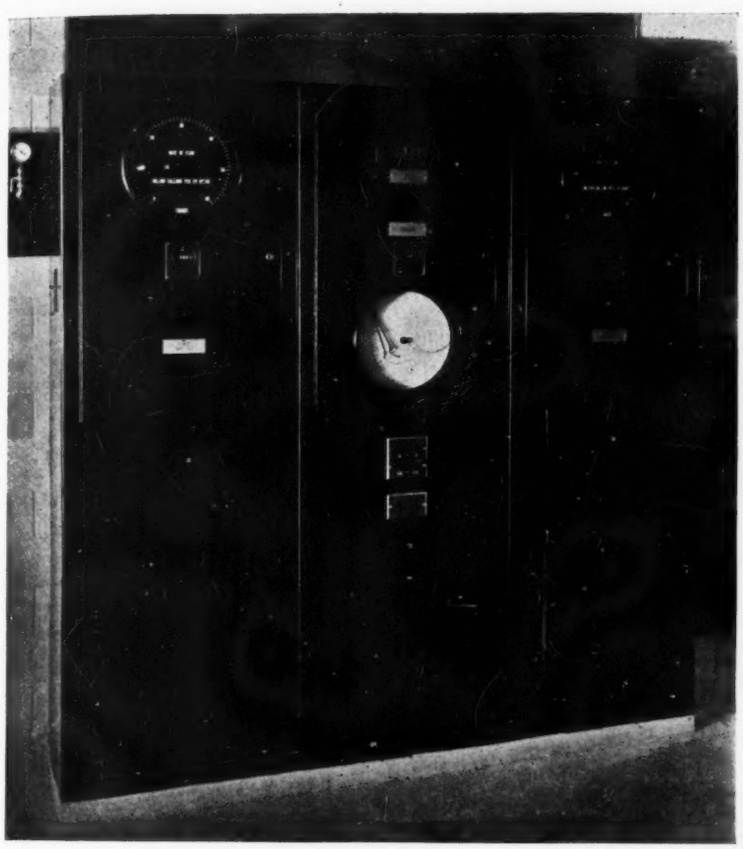
If you have a sewage disposal problem a Nichols Engineer can help you solve it.

NICHOLS ENGINEERING & RESEARCH CORP.
60 WALL TOWER NEW YORK, N. Y.

Write "Incineration Headquarters" for data on how communities are disposing of solid wastes, including sewage sludge, screenings, grit, garbage or rubbish in a sanitary and economical manner.

NICHOLS ENGINEERING & NERCO RESEARCH CORP.
60 WALL TOWER NEW YORK, N. Y.

in DALLAS IT'S Simplex AGAIN



Ratio Control and Metering Panel

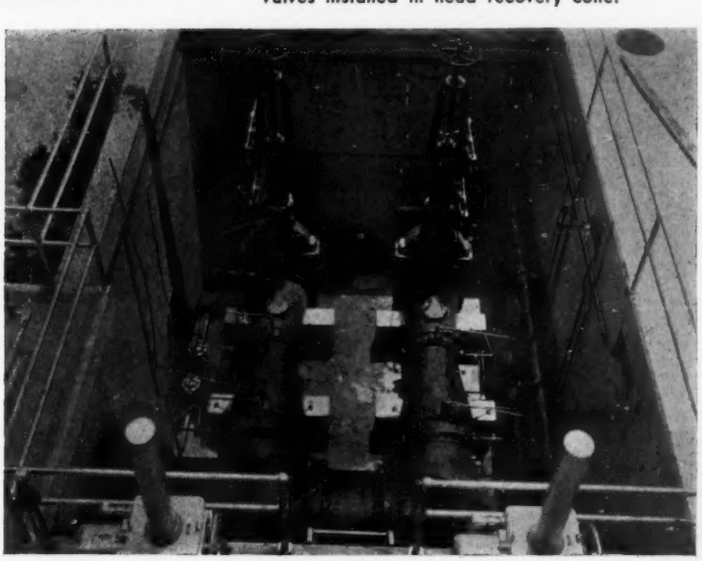
THE successful operation of the new sewage treatment works at Dallas requires the incoming raw sewage to be accurately measured, controlled and proportioned within close limits and at predetermined ratios, if the optimum efficiency and satisfactory operation of all plant functions is to be obtained.

The selection of SIMPLEX, Venturi type, "BALANCED RATIO CONTROLS" and "AIR DIFFERENTIAL" meters insures that irrespective of the operating conditions the distribution of sewage flows can be determined within the limits required.

Irrespective of whether your plant is as complete and modern as that of Dallas, or whether your problem involves the simple metering of flows or the balancing and control of sewage, sludge or air, there is a SIMPLEX instrument that will solve your problem. Competent engineers will be glad to discuss your requirements with you at your request.

WRITE FOR DATA

Metering Pit—Showing 36" Venturi Tubes with Control Valves installed in head recovery cone.



SIMPLEX
VALVE & METER
COMPANY

6743 UPLAND STREET
PHILADELPHIA, PA.

Getting Salesmen's Co-operation

Tying in Advertising with Selling

Getting out into the field

Copy Testing

DIRECT MAIL

Layout, Copy and Illustration

Market Information

contributing to the solution of general company problems

Readership of Publications

Measuring Results

ALLOCATION OF BUDGETS

Programs that management will approve

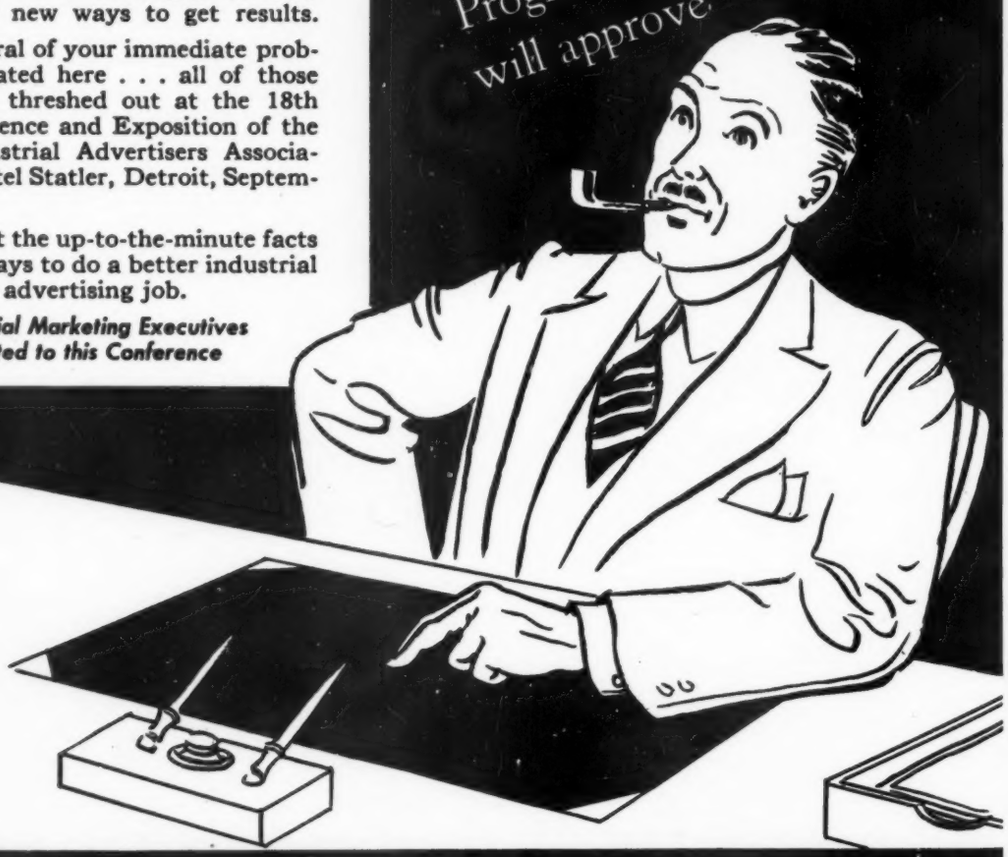
WHAT'S YOUR PROBLEM?

Your business . . . in at least one respect . . . is no different from others: ***Your marketing problems are constantly changing.*** You must ever be on the search for new ideas . . . for new ways to get results.

No doubt several of your immediate problems are indicated here . . . all of those shown will be threshed out at the 18th Annual Conference and Exposition of the National Industrial Advertisers Association, at the Hotel Statler, Detroit, September 18, 19, 20.

Plan now to get the up-to-the-minute facts on the latest ways to do a better industrial marketing and advertising job.

All Industrial Marketing Executives are Invited to this Conference



NIAA NATIONAL INDUSTRIAL ADVERTISERS ASS'N

1940 INDUSTRIAL ADVERTISING CONFERENCE

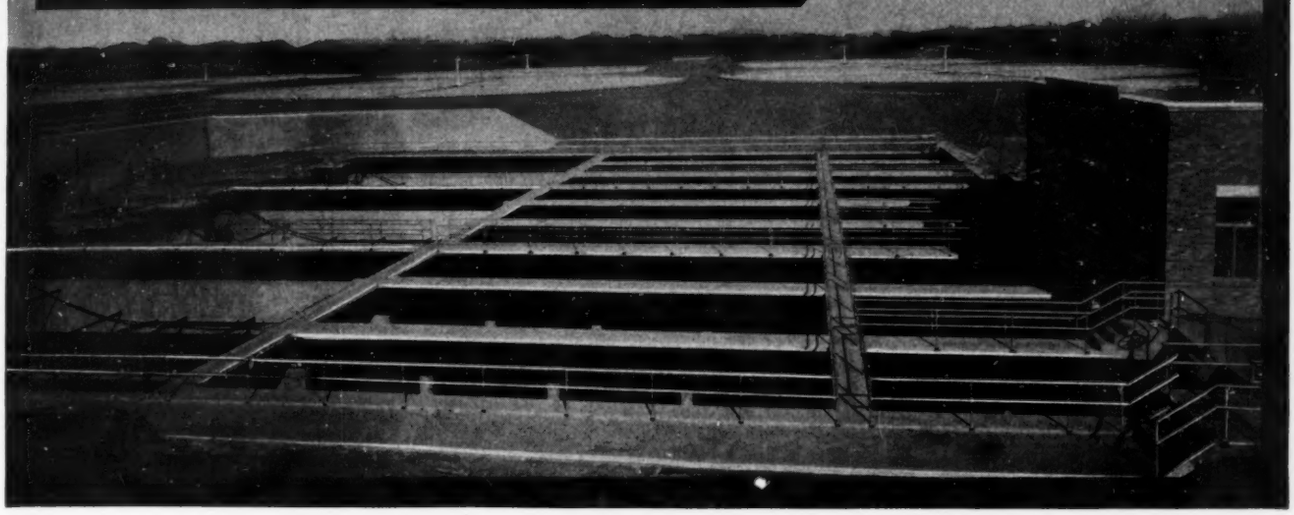
DETROIT . . . HOTEL STATLER . . . SEPTEMBER 18, 19, 20

Dallas Sewage Treatment Plant

uses BITUMASTIC No. 50

to protect . .

Sedimentation Tanks
•
Weir Plates
•
Grit Channels
•
Aeration Tanks



Secondary Sedimentation Tanks, Sewage Treatment Plant, Dallas, Texas—protected with Bitumastic No. 50

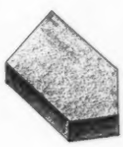
The new Sewage Treatment Plant, Dallas, Texas, is the largest in the Southwest. Serving a population of half a million and erected at a cost of $1,536,000.00, the plant represents the latest ideas in design, equipment and materials.

The sewage flowing through the Dallas Plant is especially treacherous, due partly to the discharge of waste from industrial plants. To guard against deterioration, Bitumastic No. 50 was used to protect the concrete surfaces of primary and secondary sedimentation tanks, weir plates, and the concrete surfaces of grit channels and aeration tanks—also, walls and overhead surfaces.

More and more, Sewerage and Water Works Engineers are specifying Bitumastic No. 50 for protecting surfaces that are submerged or subjected to moisture and corrosive fumes.

Bitumastic No. 50, developed from a background of over 80 years in solving the severest corrosion problems, is a coal tar base product, *applied cold* up to a thickness of 1/16 of an inch. It has a heavy, plastic appearance, but brushes out easily and may even be sprayed. Bitumastic No. 50 is not an emulsion and *contains no asphalt.* When dry, it withstands atmospheric temperatures of from 140°F to —10°F without cracking or sagging.

Write for free file-size Guide containing coating recommendations for specific parts of sewage plants and structures. (Form No. 838)



Also manufacturers of a complete line of Industrial Maintenance Paints

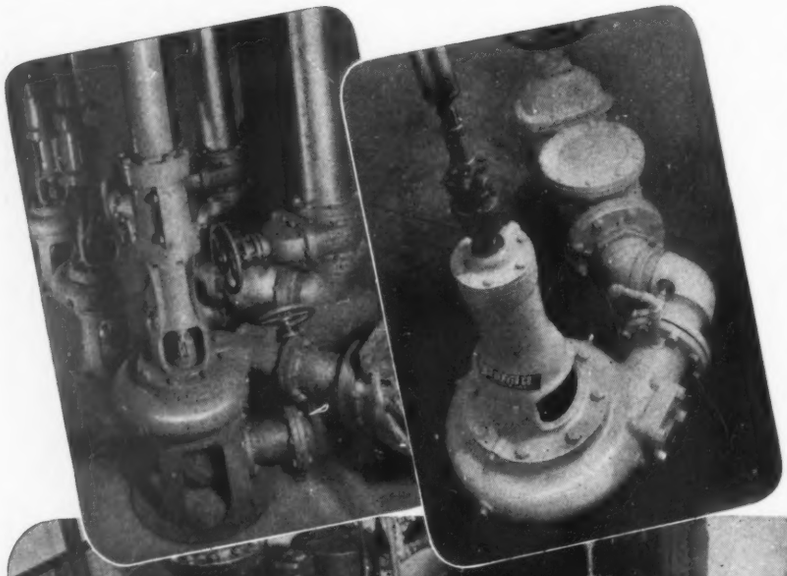
WAILES DOVE—HERMISTON CORPORATION

WESTFIELD, NEW JERSEY

NEW YORK · PHILADELPHIA · CLEVELAND · CHICAGO · HOUSTON · TULSA · SAN FRANCISCO · LOS ANGELES · MIAMI

Caught in the Act—

OF SAVING TAXPAYERS' DOLLARS



● The Gardner-Denver Centrifugal Pumps shown at work on this page were purchased for just one reason: their ability to reduce cost per 1000 gallons pumped!

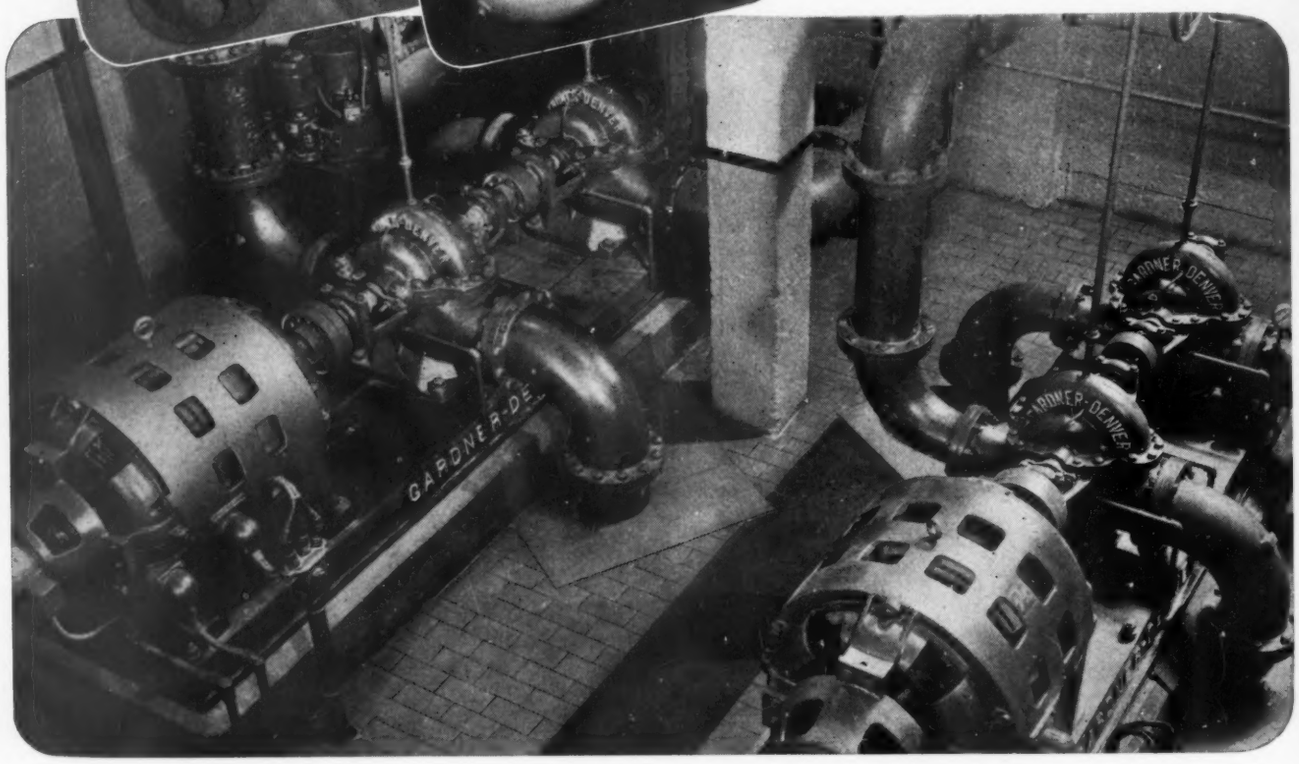
The higher efficiency and lower power cost of Gardner-Denver Centrifugal Pumps are the results of truly modern design, embodying important hydraulic and mechanical advantages. Find out how much taxpayer money YOU can save by replacing your present pumps with Gardner-Denver Centrifugals. Write Gardner-Denver Company, Quincy, Illinois.

•

(Left) *Gardner-Denver Type "K" Sewage Centrifugals cutting costs in a Midwestern Municipal Sewage Disposal Plant.*

•

(Right) *Gardner-Denver Non-Clogging Sewage Centrifugal Pump working at low cost in a large suburb of New York City.*



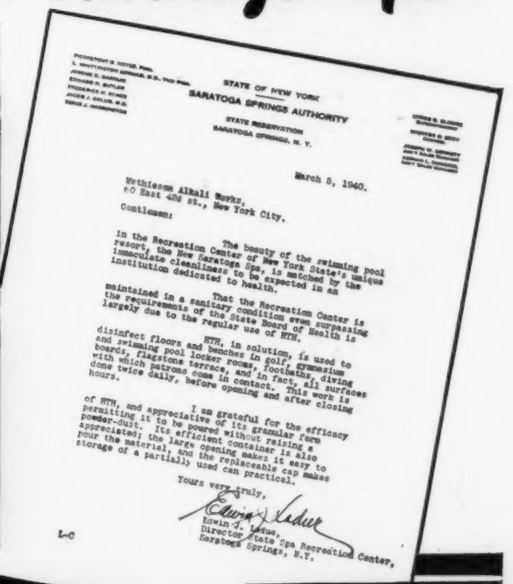
Gardner-Denver Horizontally Split Case Centrifugals operating efficiently in a large Illinois Municipal Waterworks.

GARDNER-DENVER SINCE 1859

HTH MAINTAINS EFFECTIVE SANITATION

At New York State's New Saratoga Spa

Swimming Pool, N. Y. State Spa Recreation Center Saratoga Springs, N. Y.



STATE OF NEW YORK
SARATOGA SPRINGS AUTHORITY
STATE RESERVATION
SARATOGA SPRINGS, N. Y.

March 5, 1940.

Mathieson Alkali Works,
60 East 42d St., New York City.

Gentlemen:

The beauty of the swimming pool in the Recreation Center of New York State's unique resort, the New Saratoga Spa, is matched by the immaculate cleanliness to be expected in an institution dedicated to health.

That the Recreation Center is maintained in a sanitary condition even surpassing the requirements of the State Board of Health is largely due to the regular use of HTH.

HTH, in solution, is used to disinfect floors and benches in golf, gymnasium and swimming pool locker rooms, footbaths, diving boards, flagstone terrace, and in fact, all surfaces with which patrons come in contact. This work is done twice daily, before opening and after closing hours.

I am grateful for the efficacy of HTH, and appreciative of its granular form permitting it to be poured without raising a powder-dust. Its efficient container is also appreciated; the large opening makes it easy to pour the material, and the replaceable cap makes storage of a partially used can practical.

Yours very truly,

Edwin J. Ladue

Edwin J. Ladue,
Director State Spa Recreation Center,
Saratoga Springs, N.Y.

L-C

Edwin J. Ladue, Director State Spa Recreation Center, Saratoga Springs, N. Y.

●In sending us the above letter, Mr. Ladue adds: "Besides the active management of the Spa Recreation Center, which occupies my full time in summer only, I conduct a business as consultant and adviser in the management of indoor pools in this vicinity. *My experience with HTH at the Spa pool leads me to recommend its use for similar purposes at all pools of my clientele.*"

Hundreds of beaches and pools throughout the country find the ideal solution of their sanitation problem in HTH, the dry, free-flowing chlorine carrier containing more than 70% of available chlorine. HTH quickly destroys bacteria, objectionable odors and other contamination—and is easy and economical to use.

Write today for full information on Sanitation HTH for complete, effective beach and pool sanitation.

You can buy Sanitation HTH in 5-lb. cans with replaceable covers, packed 9 cans to the case; also in drums containing 75 lbs. net.

THE Mathieson Alkali Works (INC)

60 EAST 42ND STREET, NEW YORK, N. Y.

HTH . . . LIQUID CHLORINE . . . AMMONIA, ANHYDROUS and AQUA . . . PH-PLUS (FUSED ALKALI) . . . CAUSTIC SODA . . . SODA ASH . . . BICARBONATE OF SODA . . . BLEACHING POWDER . . . DRY ICE . . . CARBONIC GAS

In 1893 - Crane Valves Opened Rochester's Water System

TODAY THOSE VALVES ARE STILL IN SERVICE

46 YEARS OF TROUBLE-FREE SERVICE PROVES ECONOMY OF PREVENTIVE MAINTENANCE

IN 1893, Rochester, Indiana, boasted a municipal water works. Naturally the valves were carefully selected. Rochester chose Crane Valves. How wise this choice, was recently proved by the need of a new disc spreader pin for one of the valves. It was the first repair on these valves—after 46 years of trouble-free service.

And perhaps surprising, but certainly satisfying to the Rochester city management, was that Crane supplied the exact repair part within a few days—thus extending the life of the valve indefinitely.

It was Preventive Maintenance that Rochester applied in 1893. It counseled a choice of valves that were designed for a specific need—valves whose superior quality would give extra resistance to the strain of service conditions.

Today, to water works, filtration plants, and sewage systems, Crane offers complete assistance in applying Preventive Maintenance successfully. With a line of over 38,000 piping items representing the finest development in flow control equipment; with unmatched laboratory and plant facilities; and with vast experience in solving industry's piping problems, Crane can supply the *right* valve for every service. And there lies the secret of dependable, low-cost piping.

Your Crane Representative will gladly help you apply Preventive Maintenance. Ask him to demonstrate how it saves where ordinary maintenance wastes.

YOU'LL HAVE PEACE OF MIND WITH CRANE A. W. W. A. VALVES

With Crane 480½'s in your streets, you don't have to worry about valve troubles when it is necessary to shut off mains or distribution lines. As you turn the stems, they'll respond—smoothly and surely.

Crane No. 480½ double disc gate valves comply with the latest A.W.W.A. specifications in effect May 1, 1939. But in service in your lines, it's their Crane-Quality that counts. It's Crane laboratory control of raw materials that gives these valves extra strength to cope with stresses and strains—that gives seats and discs greater resistance to wear. It's Crane engineering in every part that assures lasting dependability at minimum expense.

For extension or modernization of water systems at lowest cost to taxpayers, PreventiveMaintenance counsels Crane A. W. W. A. valves.

1940 OUR 85th YEAR

CRANE

CRANE CO., GENERAL OFFICES
836 S. MICHIGAN AVE., CHICAGO

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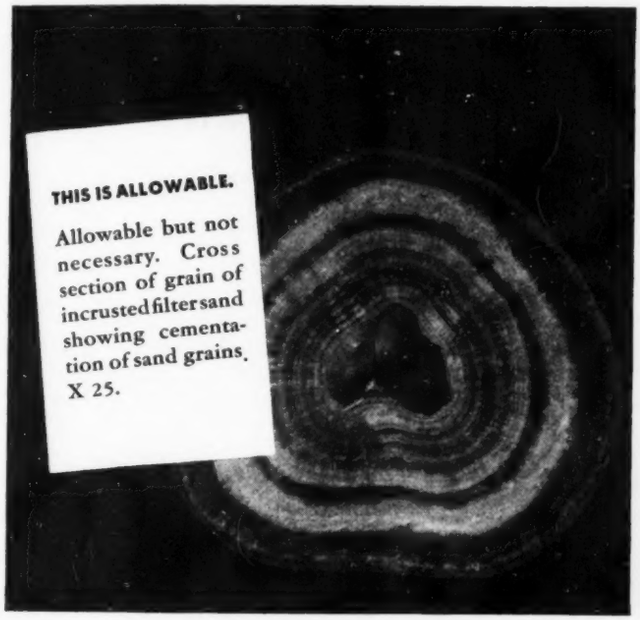
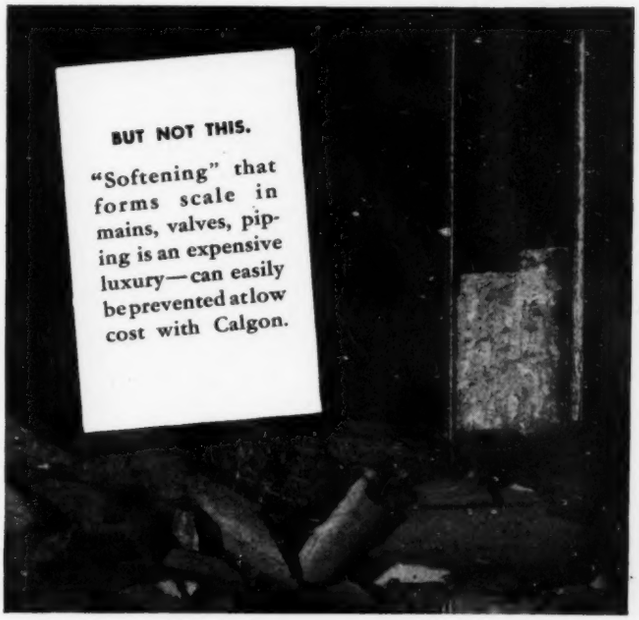
Corrosion and "red water" can also be controlled by this same low-cost treatment. The Calgon forms a thin film over the metal which offers definite protection against corrosion throughout the entire water system.

Get the complete technical background of this remarkable product by sending the coupon.


THIS IS ALLOWABLE.
Allowable but not necessary. Cross section of grain of incrusted filter sand showing cementation of sand grains. X 25.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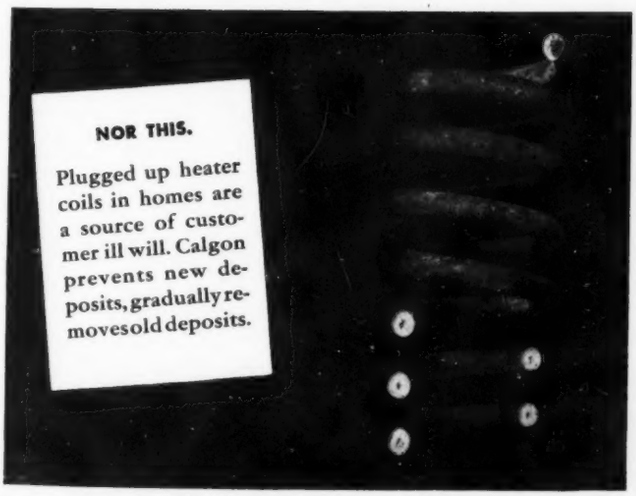
"Softening" that forms scale in mains, valves, piping is an expensive luxury—can easily be prevented at low cost with Calgon.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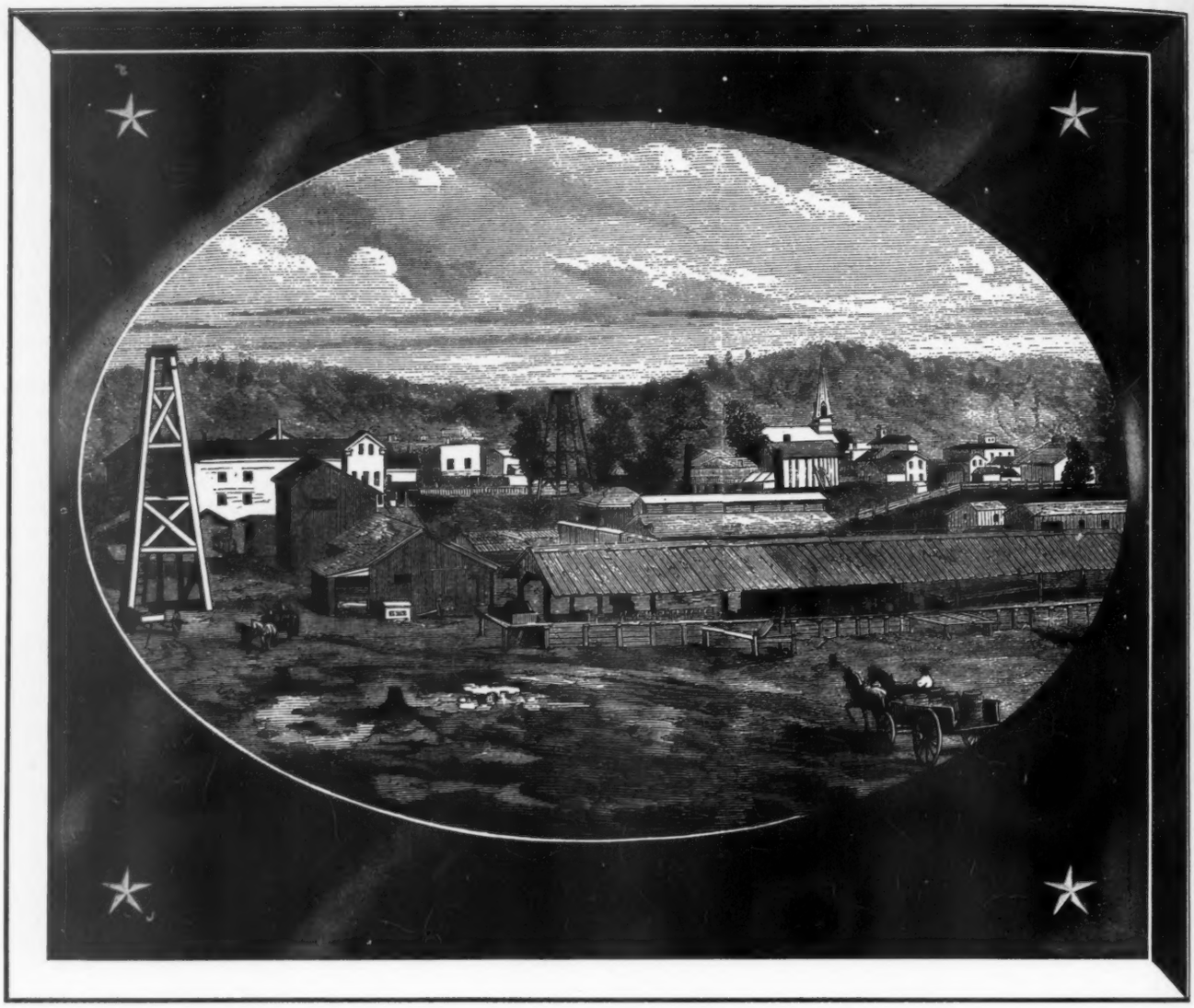

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EBG engineers, too, opened up new vistas when they first successfully produced Liquid Chlorine in America. The country's population benefited, for Liquid Chlorine provided a powerful weapon in the war against water-borne diseases. By its effectiveness in the purification of water supplies and in the sterilization of sewage, EBG Liquid Chlorine has made possible new standards of public health. And the paper and textile industries benefited by the more efficient, economical bleaching methods made possible by EBG Liquid Chlorine.

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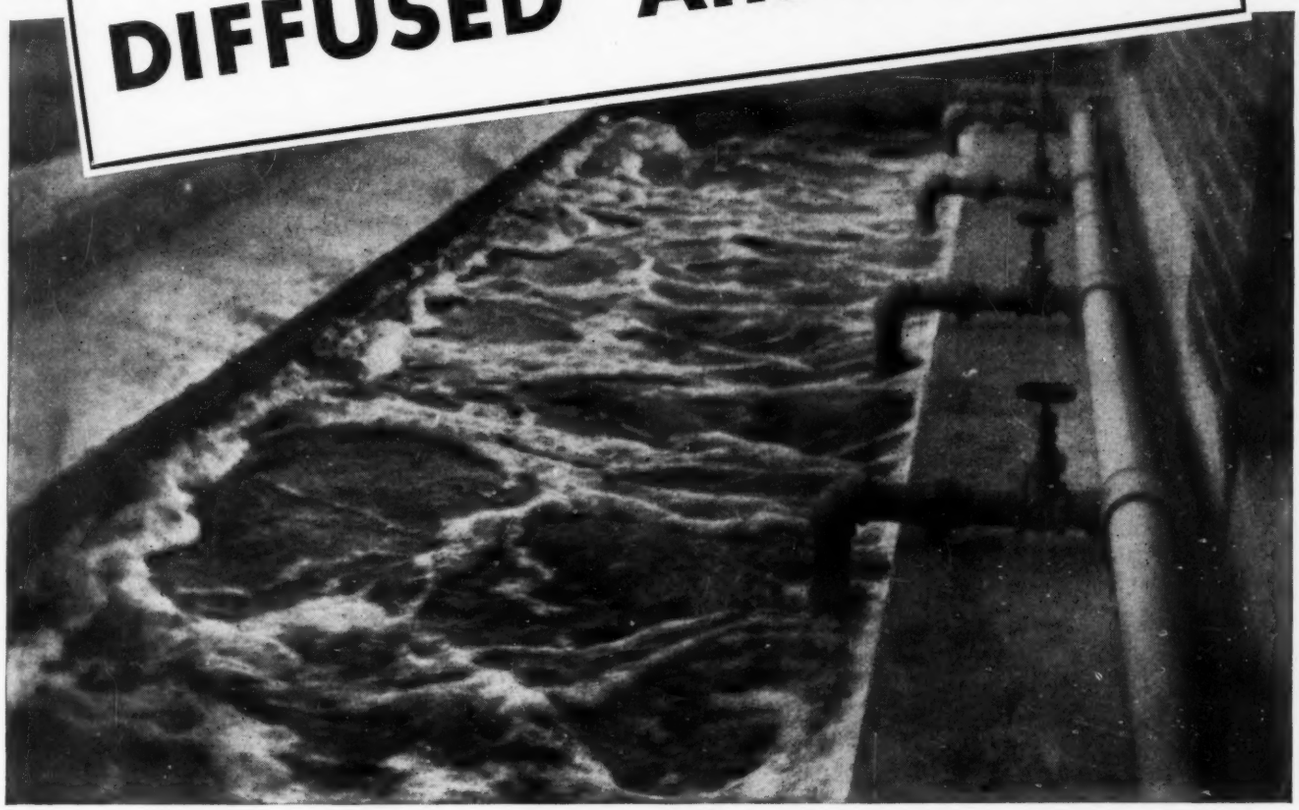

● At the 1940 Kansas City meeting of the A.W.W.A. a spirited discussion took place on taste and odor control. "Break point" chlorination, activated carbon treatment and other known successful methods were described as scheduled but *strong evidence of the supplemental value of aeration was introduced.*

Aeration by diffusion of air through porous media reduces the job to be done by subsequent methods at a lower cost per unit of work done. In some cases it will do the job alone but where strong tastes and odors exist it should be considered as a pre-treatment to reduce the overall cost.

And remember the extra benefit of chemical mixing which is possible at no additional cost when air diffusion is used for aeration. Diffused air mixing is the most thorough obtainable.

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"The new superintendent told *you* how to run the water works?"

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The parallel seat, double wedge type slide gate valve, developed and perfected by Ludlow, has been the universally accepted construction in all waterworks valves for nearly three-quarters of a century. It provides all these essential benefits:

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Ready Replacement of Parts. Simple construction with ample tolerances, permitting ready replacement of parts.

LUDLOW PRINCIPLE
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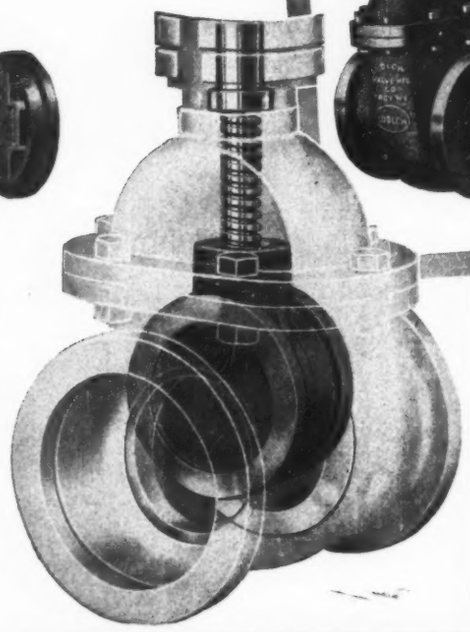

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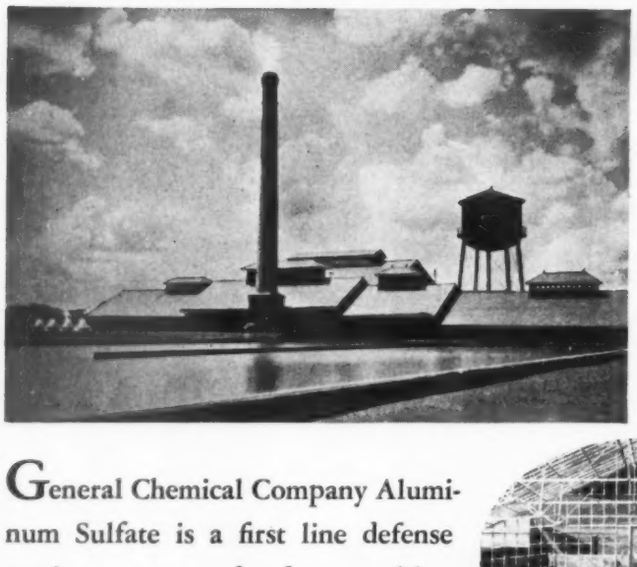
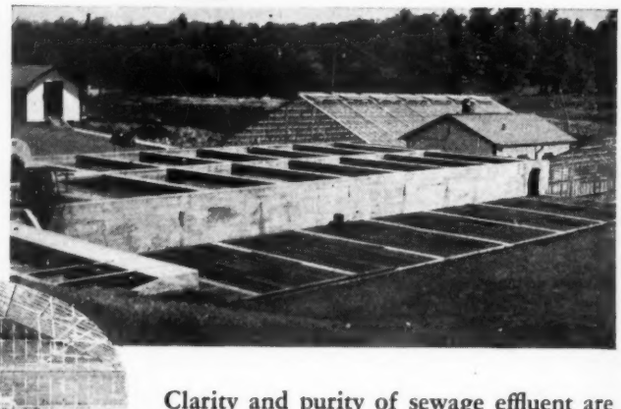
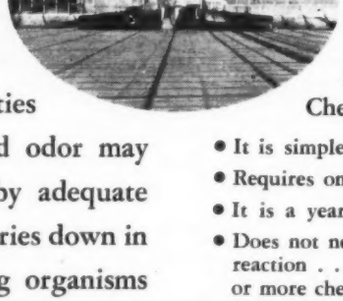
FOR COAGULATION OF WATER AND SEWAGE







General Chemical Company Aluminum Sulfate is a first line defense against taste and odor troubles, supplementing other methods of control. Prominent water works authorities state that 25% to 50% of taste and odor may be removed in the settling basins by adequate coagulation. Such coagulation also carries down in the settling basins the filter clogging organisms which shorten filter runs.

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WATER WORKS & SEWERAGE

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COMING!

"The Results of Better Maintenance and Sizing of Water Meters"

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H. W. GRISWOLD,
Deputy Chief Engr. and Mgr.
Water Bureau of Hartford, Conn.

"Oil Field Waste Water Disposal"

In California the oil producing industry is spending close to $5,000,000 yearly to properly treat and dispose of the waste waters from well drilling and oil field operations. A vast amount of experimental and developmental work has been entailed in providing effective treatment and disposal of these waste waters. Much of this, and a description of treatment methods perfected and plants constructed, is the subject of a series of highly interesting articles coming from—

WALTER HUMPHREYS, Manager
Santa Fe Springs Waste Water Disposal Co.
and
A. M. RAWN, Ass't. Chief Engr.,
Los Angeles County Sanitation Districts

"The Cost of Main Extensions"

Will prove extremely helpful to all whc have the job of estimating the cost of installnig new water mains or making main extensions. The author some two years ago contributed to this magazine a reference tabulation of the several items entering into the cost of making main extensions. Now he has produced a revision and extension of this reference table making it even more exact in respect to individual cost items, and consequently of enhanced value to managers and designing engineers.

The author—

D. R. TAYLOR, Plant Superintendent
Water Department of Roanoke, Va.

"Rates and Rate Making"

Is a discussion of the basic elements that enter into making water rates, with especial emphasis on the matter of preventing loss from water sales and avoiding setting up rates which may prove discriminatory.

The author—

C. K. MATHEWS, Engineer
Burns & McDonnell Engrs., Kansas City

"Improving the Operation of a Small Sewage Plant"

Relates experiences of a small plant operator with an inventive turn of mind, who has developed several worthy and inexpensive contrivances and methods to stabilize his plant performance and cut operating costs. It constitutes one of the most worthy and inspiring operating articles that we have seen in a long time. The inquisitive and inventive author is—

C. G. WEBER, Superintendent
Annapolis (Md.) Sewage Treatment Works

"Rapid Sand Filters for Sewage and Trade Wastes"

Is the subject covered in the author's usually thorough and effective manner in two articles dealing with the present status of the practice of mechanical filtration of sewages, wastes and effluents. In this article the equipment now available on the market for such purposes is described, and features discussed. With performance data and operating results touched upon, these articles will comprise a reference work of value to engineers and plant managers interested in improved effluents and operating economy. The author, with many years of mechanical filter experience as a background, is—

PHILIP B. STREANDER, Consulting Engr.
New York City

VOL. 87, NO. 6 — June, 1940

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This Month's Cover—Is dedicated to the newest amongst America's most important sewage treatment plants—that of Dallas, Texas. Pictured is the Main Operations Building, beneath which are the unique "aero-chlorination" chambers for degreasing and deodorizing the sewage. Completely sealed, all expelled gases and spent air leaves by way of the stack in the rear.

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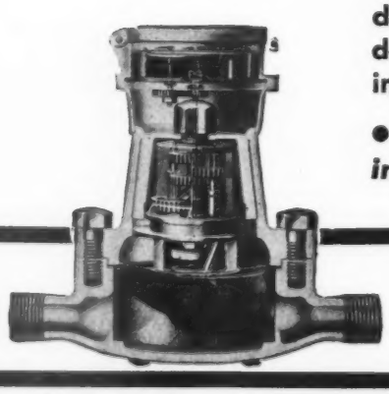

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WATER WORKS & SEWERAGE

VOL. 87, NO. 6 *A Gillette Publication* JUNE, 1940

THE NEW SEWAGE TREATMENT PLANT OF DALLAS

Goes Into Operation With Several Novel Features and Emphasis Placed on Flexibility and Dependability of Operation

By R. M. DIXON
Senior Engineer*
Department of Public Works
DALLAS, TEXAS

ON the morning of April 16, 1940, Dallas opened the valves to its new sewage treatment plant, and thereby tossed a major pollution problem of the Southwest into the sanitary archives. The new Dallas plant is designed to serve a population equivalent of 500,000. According to the final audit it has cost $1,535,000. Part of this cost was obtained from the Federal Government as a P.W.A. grant, the balance being provided through the sale of ten-year bonds that sold at a price to yield an interest rate of 2 per cent. Money available at such an attractive interest rate, plus the government offer, placed the city in an advantageous position with respect to paying for the project and proved a factor of no small proportion when the financial side of the matter came up for consideration. The average rate for all other City of Dallas bonds outstanding is approximately 4%.

The Author

As early as 1930 Dallas realized that the then existing treatment works, consisting of 24 Imhoff tanks, were no longer adequate for the treatment of the city's liquid wastes. An effluent of higher quality appeared to be a necessity. It was about this time that Dallas, under remedial pressure from the Texas State Department of Health, was asked to correct the situation. As an outcome of this action, in 1931 and 1932 the City collaborated with the Texas Engineering Experiment Station in a series of studies at the Dallas plant. These embraced the character of the waste to be treated, its volume and flow characteristics, the methods of treatment available to the city and their applicability to the local problem. At the same time a fairly thoroughgoing study of the re-aeration rate of the receiving stream — the Trinity River — was made.

A Study of Sewage and Treatment

The processes of treatment investigated included activated sludge, chemical precipitation, the Hays Biological Process (developed at Waco, Texas) and trickling filters. Almost from the beginning of these studies evidence seemed to point toward trickling filter treatment as the most practical and economical scheme for Dallas.

In order to understand why, it will be necessary to briefly review the sewage collection problem, for it has a rather definite bearing on the treatment problem. The city has two sources of water, one is a surface supply and the other a ground water supply. The first presents no significant difficulties but the ground water does. The wells are approximately 2700 feet deep and discharge

*During Construction of the Plant Designing Engr. in Charge of Construction.—Ed.)

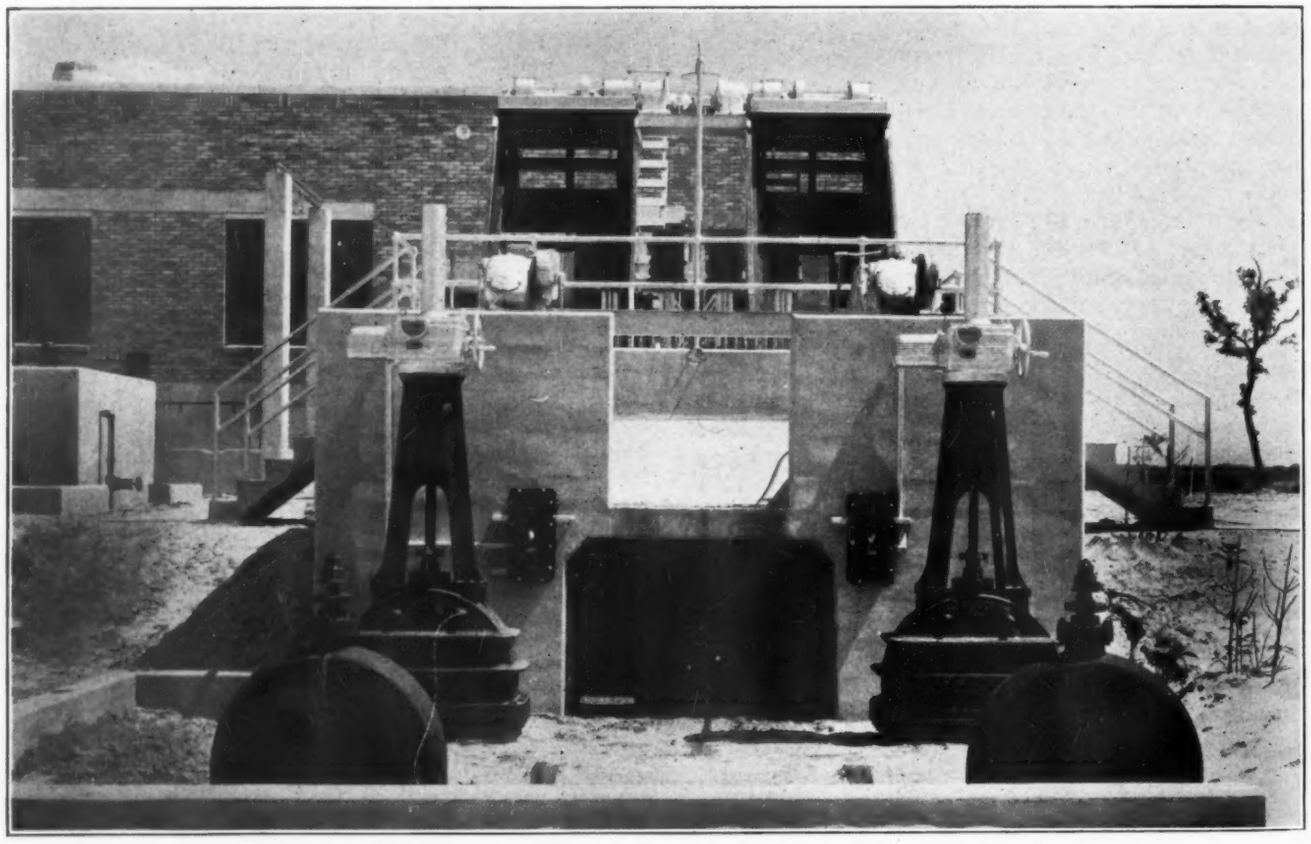
In constructing the Dallas plant we have builded on the efforts of those that have gone before us and if our building proves to be good we have only these to thank. Without them this plant could not have been built, and for them we hope that we can in some way so operate it toward the goal of adding something to the information that has been compiled by them in the field of waste treatment. If we can do that we will be able to repay, in some small way, the great amount of help that has been so freely extended to us. —The Author.

[*A paragraph lifted from the end of Mr. Dixon's article to this position.—Editor.*]

a water that has a temperature of about 108° to 110° F., a pH value of 8.2, and a mineral content of about 1100 p.p.m., a large portion of which is sodium sulfate. This water reaches the consumer's tap with no cooling except the thermal losses that occur along the distribution lines, and this is not appreciable during the summer months. In the sewers this high temperature condition creates a perfect environment for a rapid biological activity that is apparently dominated by sulphate splitting organisms. The result is that free sulfides appear in the waste before the sewage reaches the treatment plant. Pre-chlorination to prevent septicity in the lines was decided against when field tests revealed that the waste already had an immediate chlorine demand of 50 parts per million when sampled at the junction points of the 6- and 8-inch sewers. This seemed a rather astounding observation, when realizing that an average flow time of only about 30 minutes existed from the house service to the junction point. By the time this waste reaches the trunk interceptors free sulfides are definitely present.

The city's water supply involves a maximum of about 8,000,000 gallons daily from this source. Private wells that tap the same sands produce an unknown amount, probably about one-half the City's production. Of course, all of this water does not find its way into the sewer system but the proportionate amount does and its influence is very definite.

In addition to the chemical condition that results from these warm, high-mineral-content waters, the collection system presents an even greater problem that had to be accepted in considering the type and capacity of the treatment plant. Like all other similarly laid out collection systems, the Dallas works were designed to provide for storm flows. The city has separate sewer systems, but it inherited through annexations, an appreciable amount of open joint collectors that were laid in rock trenches, and in addition to this entry of storm water, we have the inevitable roof drain connections to the house laterals, both of which contribute to a considerable increase in flow during the wet weather periods. The sewage is collected by gravity flow to two lift stations. One station is located at the treatment plant site and the other about three miles away, both stations discharging to the plant through force mains, the line from the more remote station having an inverted syphon for the river crossing. The ratio between peak wet weather pumping rates and the early morning dry weather rates through these pressure lines is about 14 to 1. The result is sedimentation in mains when the velocity drops below the scouring rate. The morning pumping rates re-establish scouring velocities and slugs of partially decomposed material arrive at the treatment plant. Grab samples taken during the morning hours show pH values varying between 8 and 11, suspended solids as high as 2000 parts per million, 5-day B.O.D.'s better than 1000 parts per million, about 200 parts of which is in solution. Naturally there is no dissolved oxygen present when this condition prevails, and little if any at other times. The waste is vicious in appearance and as it flows from the pressure mains it releases odors that are extremely offensive and possessed of carrying characteristics that tend to make them troublesome at times. Perhaps these stale sewage odors are not all chargeable to the low velocities and the subsequent septic condition of the sewage when it reaches the plant; in fact, we know that they are not. Uncontrolled industrial wastes amount to about 33% of the total organic load and during certain periods of the day these wastes are the predominating influence as far as treatment is concerned. It is hoped that this problem will sooner or later be remedied by ordinance or by agreements.



The Main Sewage Entrance
Twin Bar-Screens and Grit Removal Units

The foregoing recital of facts may not set Dallas apart from numerous other municipalities, but it does offer a partial explanation as to why the activated sludge and chemical precipitation processes did not produce entirely satisfactory results during the experimental test runs. Dallas sanitary wastes are strong and stale, and are difficult to treat. Certainly the selection of a treatment process without conducting actual experimental studies of small plant scale proportions could not have been safely done.

Selecting the Method of Treatment

In selecting a method of treatment the city had to recognize these aforementioned sewage characteristics and had to keep in mind that the treatment had, first, to be reliable and positive. This for the reason that the effluent will have to be discharged without any appreciable amount of dilution at certain times in the receiving stream. Four impounding reservoirs have been constructed on the watershed above the plant and the operation of these reservoirs as storage and flow control units is as yet an unknown factor. At times there is apt to be only a requisite minimum flow past the treatment works. Reaeration studies of the stream indicated that with an average expected flow in the Trinity an effluent of not more than 50 p.p.m. oxygen demand (5-day B.O.D.) would be required, and that such an allowable would probably have to be based on an effluent carrying a high nitrate content. The type of treatment to be selected had to be based, first, on the type of effluent that it would produce; second, on the over-all cost per million gallons to produce that effluent.

The Texas law on stream pollution reads in part as follows: "The effluent discharged into the stream shall be of such a quality as will not impair the usefulness of the stream." The Texas State Health Department, through its broad police powers, further restricts the allowable pollution in the following terms: "Any effluent discharged into a stream must not reduce the dissolved oxygen content of the stream below 2 p.p.m., and must carry a bacterial reduction that will not overburden water plants located below the point of discharge." Insofar as the city of Dallas was legally concerned, the governing state requirement was that section dealing with the dissolved oxygen in the stream. There are no water plants located below the point of discharge.

"J.B." Takes the Wheel
John B. Winder, Sup't of Water Works and Sewerage, *(was something of a "King-pin" on this project from the beginning straight through)*

Basis for Design

The design has been made on the basis of satisfying the local problem in terms of the local need, all based upon statutory compliance. Treatment methods have been provided to carry purification beyond that actually needed at times. However, since the operation of all of the equipment provided will increase operating costs, its use for additional treatment will be predicated upon the observed condition of the stream below the point of discharge. While it is true that no city should be allowed to exploit a river by converting into a menace to public health or a nuisance producing waste way, by the same token no city should be penalized by regulations that require a degree of treatment more than that which is commensurate with the correction needed. Control measures that gain the support of water works men should be based on the study of the individual problem before remedial correction is attempted, because wastes vary widely in character and each receiving body of water has its own load stabilizing capacity and recovery rate. Utilization also varies and so long as the present methods of treatment are the accepted standards, the selection of a method should be made only after a full and complete investigation has been followed through and all known facts evaluated in their true relationship. Such an investigation should begin with the bond market and continue through to a point where the full natural capacity and complete stream recovery or stabilization is no longer a matter of question. It was our thought that then, and not until then, is a municipality ready to start drawing plans and preparing contract documents. Dallas tried to follow such a procedure, and in doing so, the trickling filter type of plant was selected when the end of that trail was reach.

Why Trickling Filters?

In arriving at this selection from the financial side, evaluations were made of three types of treatment; these were activated sludge, chemical precipitation and trickling filters with the benefits of all doubts being extended to the chemical precipitation and activated sludge processes. In the end the trickling filter was selected on a basis of *overall* cost of treatment, as well as on the basis of dependability of functioning and the *net* results to be expected. The operating tolerance was small, the raw sewage conditions severe, and the experimental studies seemed conclusive. Technically, then, there was no very close choice. The trickling filter proved that it would take shock loads and perform more consistently than either of the other processes. Shock loads must be expected from industrial wastes that are not controlled and so long as this high organic load has to be handled (population equivalent of about 150,000) this factor necessarily had to be placed high on the design list. Thus, we felt that a large amount of consideration must be extended to the shock-absorbing type of plant for Dallas conditions. The first cost, however, proved our next concern.

The trickling filter was a bit in disfavor with the taxpayers' league for it was the most expensive type of

plant from the standpoint of first cost, and it is readily conceded at this point that the financial aid obtained as a federal grant through the Public Works Administration and the low rate of interest wielded a decided influence in the financial picture and made it more convenient to make a heavier capital investment in order to obtain positive and consistent treatment results at the lowest calculated overall cost per million gallons. With only this purpose in mind, and in the light of all the known facts, a recommendation was made to the City Manager. Action by the Council authorized the Director of Public Works to prepare plans and specifications for a trickling filter type of plant. However, before the ink was dry on the first work sheet the type of plant chosen became a matter of private and commercial concern, and much opposition was raised as to the type of treatment selected. Owners of tried and untried patented processes appealed to the Council for a hearing. A bewildered Council felt it wisdom to call in disinterested advisers and Black and Veatch, Consulting Engineers of Kansas City, Missouri, were retained to review the situation and to make a recommendation to the Council. Their conclusions as delivered to the Council on December 27, 1937 were . . . "(1) a sewage treatment plant of the trickling filter type is best adapted to the requirements of Dallas; (2) the plans, prepared by Andrew P. Rollins, Director of Public Works, on which bids were received December 23, follow the correct basic design, and the general basis of design for the trickling filter plant and appurtenant construction . . . has been checked and approved." And so ended serious and disturbing efforts to upset the decision of the Public Works Department as to the type of plant best suited for Dallas conditions.

The Plant Layout

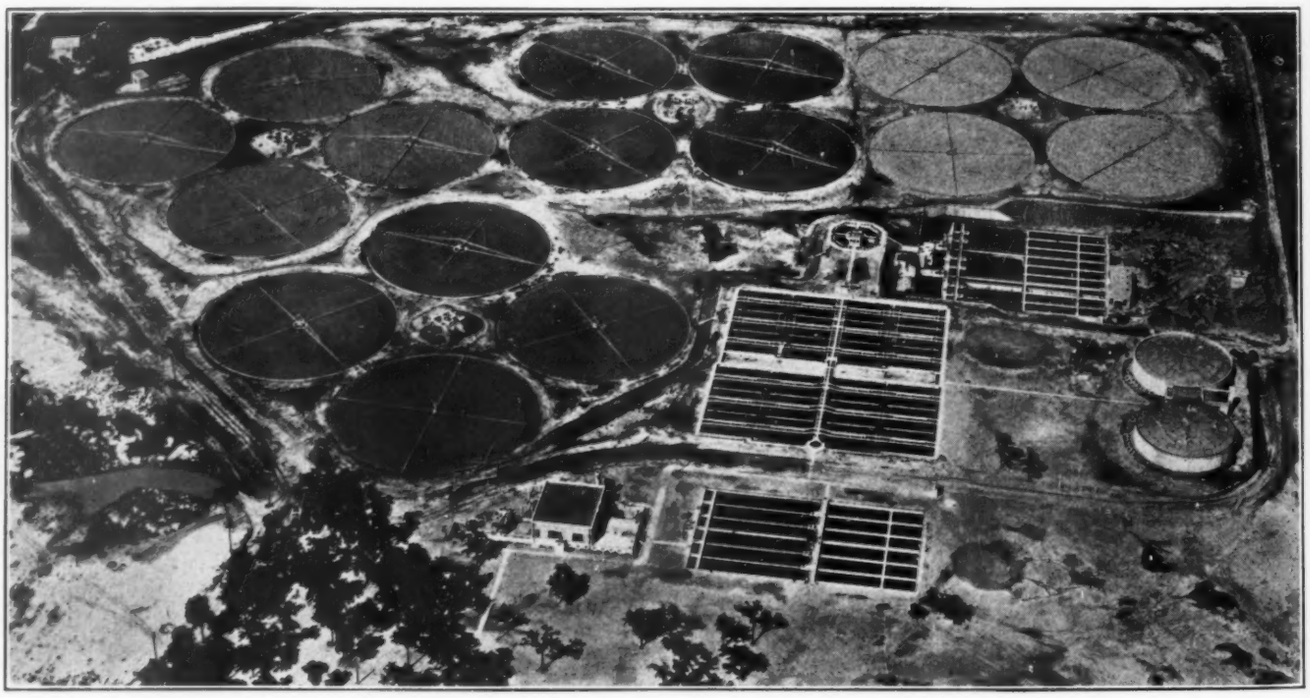
The plant as designed and built provides for screening, grit removal and its washing, grease skimming and odor control, metering and flow diversion, sedimentation and separate sludge digestion in parallel with Imhoff treamtent, trickling filters and final sedimentation. Further provision is made for reducing the load on the filters by chemical precipitation (using the air agitated grease skimmer for mixing) and increased filter efficiency will also be obtainable by the provisions in the design wherein the filters may be operated in two stages, or the settled sewage can be diluted by effluent return to the Control Chamber. Space has been left for the construction of straining filters for the final effluent, if and when needed. And provision has been made for additional units in future years. The arrangement of the various units leaves much to be desired, but physical features, property lines and existing structures and sewers made it necessary to locate the filters as shown. The units are listed in their treatment sequence:

1. Bar Screens and Grinder

Two Link-Belt rope type bar screens with 1-inch clear openings are totally enclosed and automatically raked. The screens operate on an adjustable differential float control and discharge the screenings on to a belt that feeds a Gruendler grinder, the shredded material being returned to the flow channels behind the screens. A differential head float-switch trips the rake mechanism with the intermittent cleaning cycle, and starts the grinder and feeder belts. The grinder operation is automatic, starting when either or both screens are being raked.

2. Grit Removal

The plant influent is received through twin grit channels that are equipped with Link-Belt grit collectors and screw conveyors. Either channel can be taken out of service by means of a motor operated valve on the influent end. Weir gates (adjustable from the operating floor) are provided at the effluent end of the channels. Studies of the inorganic matter in the sewage indicate that about 90% of it is larger than 60 mesh and that it can be removed in 50 ft. channels if the velocity through the channels is controlled. The grit will be washed, conveyed to a hopper and disposed of by dumping. [For an excellent group of papers on the subject, "Grit—Its Collection and Washing," see the April, 1940, issue of this magazine.]



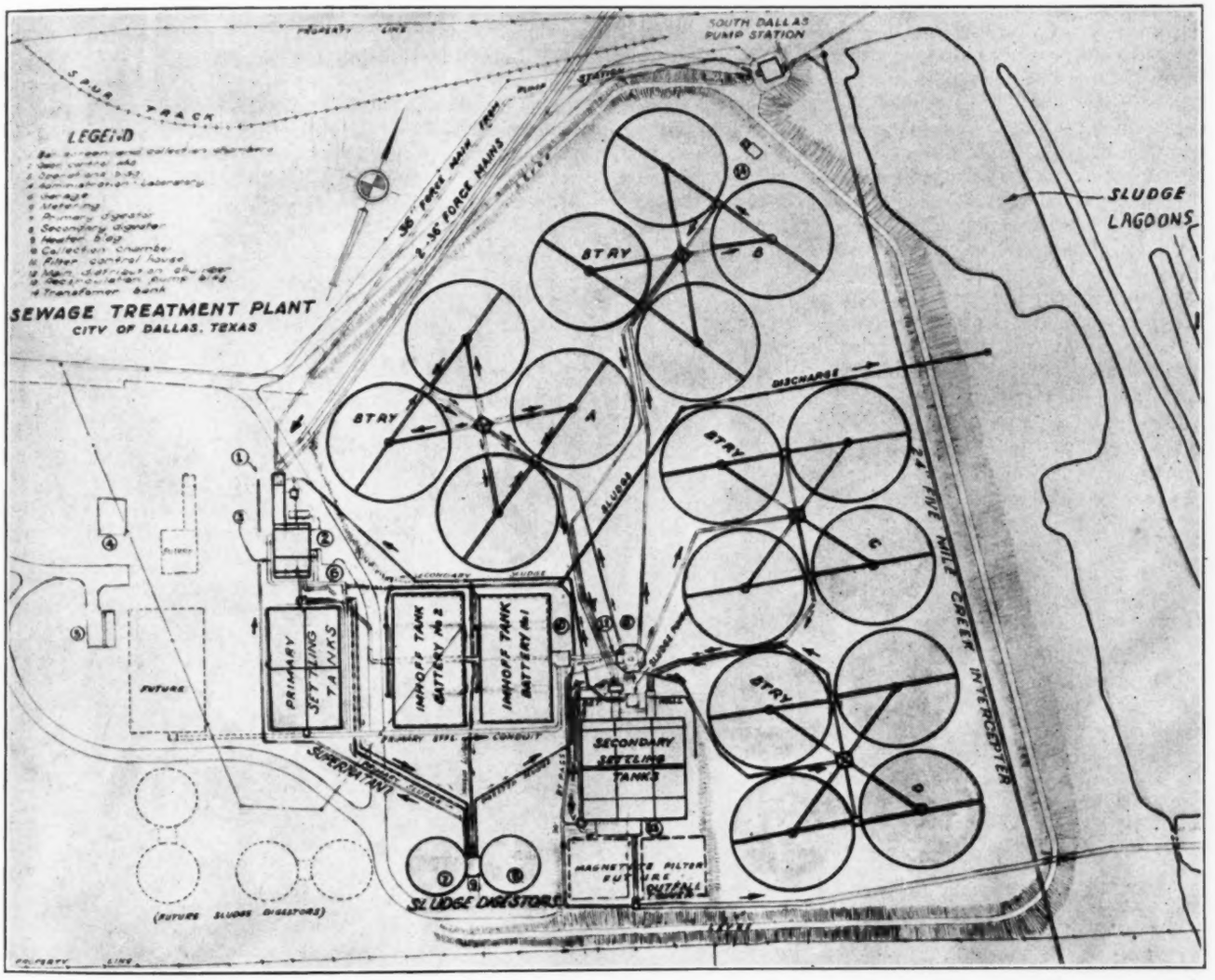
And Now a Plant on the Banks of the Trinity at Dallas
Note that the right-rear battery of filters was not operating

3. Grease Removal and Odor Control

The design has been rather specialized and amplified at this point, partly because of the condition of the sewage when it reaches the plant and partly because the plant is not too far removed from populated areas. In semi-tropical climates certain types of sewage odors have a decided tendency to travel with the prevailing winds, especially during the early part of the night. To offset this, the sewage reaching the plant is completely confined in air-tight enclosures that house the bar screens and grit mechanism. It is blown with plain air, then chlorinated air, and may have iron salts added to "fix" any residual free hydrogen sulphide, or that subsequently formed. The sewage thus treated enters the flumes feeding the sedimentation units.

Three Roots-Connersville blowers deliver a maximum of 1100 cu. ft. of free air a minute through 220 sq. ft. of Carborundum "Aloxite" diffuser plates (30 permeability) arranged in the conventional ridge and furrow way, each furrow being made up of eleven plates. Odor control is further augmented with 2 Wallace and Tiernan master feed solution type chlorinators of 2000-lb. capacity per day and 1 Wallace and Tiernan dry feed type chlorinator, having a capacity of 1000 lbs. per day. The solution feed machines will be used for producing chloride of iron or chlorinated-copperas, or for adding chlorine to the grit channels. The dry feed chlorinator is used in "aero-chlorination" for grease removal, dry chlorine being fed into the air lines leading to the second pass of this odor control unit. This air-sweep grease removal unit provides a total detention of 8 minutes for design flows. During the first 4 minutes air alone is applied, and the second 4 minutes consists of "aero-chlorination." The ridge and furrow arrangement was selected as preferable for grease separation to spiral flow. The spent air and released gases are trapped under the roof of the structure (which is also the floor of the operations building) and are directed into a stack for washing and further treatment if needed. The grease and scum released from the sewage is swept by flat (fish-tail) water sprays to an area from which it is automatically removed at time-clock-controlled intervals.

The sprays jet the surface from a 10 to 20 degree angle and sweep the scum toward the scum box. The time clock control energizes a set of solenoids on the water line leading to a hydraulically operated dipping weir gate that opens into the scum box, and lowers the gate until an adjustable electrode, attached to the gate



General Plan of the Plant

1—*Bar Screen and Grit Collection Chambers*
2—*Enclosed Odor Control Chambers*
3—*Operations Control Building*
4—*Laboratory and Office Building*
5—*Garage*
6—*Meters and Flow Control*
7—*Primary Digester*
8—*Secondary Digester*
9—*Gas Control and Heater Building*
10—*Settled Sewage Collection Chamber*
11—*Filter Control Station*
12—*Main Distribution Chamber*
13—*Effluent Recirculation Pumps*
14—*Transformer Bank*

frame, touches the variable water surface in the structure, thereby closing the solenoids and arresting the travel of the gate at any predetermined differential below the varying water surface. When the operating cycle is ended the clock raises the gate and shuts off the supply line to the sprays. This unit has an allowable of 4 inches of variation in the water surface between high and low flows but this does not affect the action of the sprays or the dipping weir gate. The bar screens, grit channels and grease skimming-odor control unit is a continuous structure totally enclosed except for the stack opening. Inspection doors and windows are freely provided but all close with a gas tight fit.

When and if chemical precipitation is needed for reducing the load going to the filters the air supply can be adjusted to provide for chemical mixing in this structure. Two (2) Wallace and Tiernan dry feed machines, with capacities from 50 to 750 lbs. of iron sulfate per hour, will be used for feeding dry chemicals to a chemical mixing box.

4. Metering and Flow Control
(Involving special Equipment.)

When it was decided to increase the sedimentation period over and above that available in the existing Imhoff tanks that are being retained and used as previously, the problem of dividing the flow between the new and the old settling unit had to be solved. It was desirable to divide the flow on a non-varying proportionate basis, regardless of the volume of the total flow, and to provide a satisfactory means for changing this ratio at will or for diverting all the flow to either side of the plant during an emergency. It was solved by installing a Venturi tube and throttling valve in each of the two feed lines leading from the scum removal structure and hooking the valve operating unit to a ratio control that would operate from a float that rests on a varying water level in this unit. The allowable level variation was set at 4-inches between low flows at 5. m.g.d. rates to high flows of 45 m.g.d. rates.

The ratio is determined by the manual setting of a pointer on the control board, the division of flow being split to the two sides of the plant between the guaranteed limits of 25% and 75% of the total flow going to either side as desired. In other words, automatic ratio control can be had if neither tube carries more than 75% nor less than 25% of the total flow through the plant. The valves also act as positive shut-offs. The guaranteed accuracy of control is 5% between the above limits and the metering is within the conventional 2% over all guaranteed accuracy. The control board provides indicated flow, recorded flow for each tube and recorded total flow, and totalized flow for each tube plus a combined total for the unit as a whole.

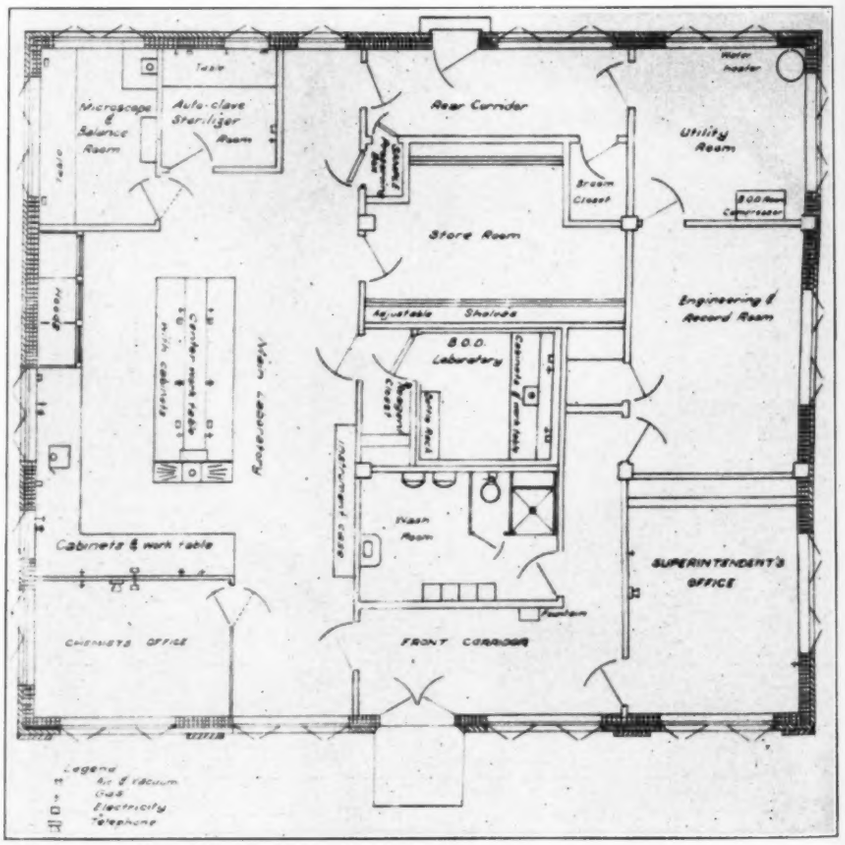
The units have adequate capacity to take storm flow rates through either the new sedimentation units or the old Imhoff units, thereby almost entirely eliminating the necessity for by-passing any raw sewage even during storm periods.

5. Primary Sedimentation

The 24 Imhoff tanks that comprised the old plant have a theoretical detention period of 1½ hours at the average daily peak rate of 32 M.G.D., but the design of the influent channels, the baffles and flow chambers is such that the actual detention is less than 30 minutes at the higher flows. This could have been partially corrected but since the units are about 20 years old it was deemed advisable to parallel them with additional sedimentation units equipped for continuous sludge removal. Two rectangular tanks (50 ft.x180 ft. with 11 ft. water depth) were constructed and equipped with Jeffrey chain and drag type sludge collectors. The front (inlet) half of the tanks provide for scum skimming, whereas the rear (outlet) half is given over to H-type effluent weirs. Scum is cross collected at the *center* of the tank and removed from the tanks in the same manner as that described under section 3.—Grease Removal.

The mechanism drives, excepting those for the sludge cross collectors, are located along the cross walk above the scum collection channels, providing motive drive at the center of the tanks for the two ends instead of at the influent end only as is the usual practice.

Particular attention has been given to the design of the settling tank's influent channels, ports and baffles and an effort has been made to compensate for uneven flow distribution by placing additional baffles at the center section. In order to secure even distribution across the tank the influent conduit turns the flow from horizontal to vertical before it is introduced at the center of the tank into a tapering cross channel that is provided with feed ports 12 inches in width and located 18 inches apart. In addition to this provision for killing the



Plan Showing Laboratory Arrangements and Offices
(Because of the many favorable comments on the laboratory of the Dallas plant we particularly wished this sketch included.—Ed.)

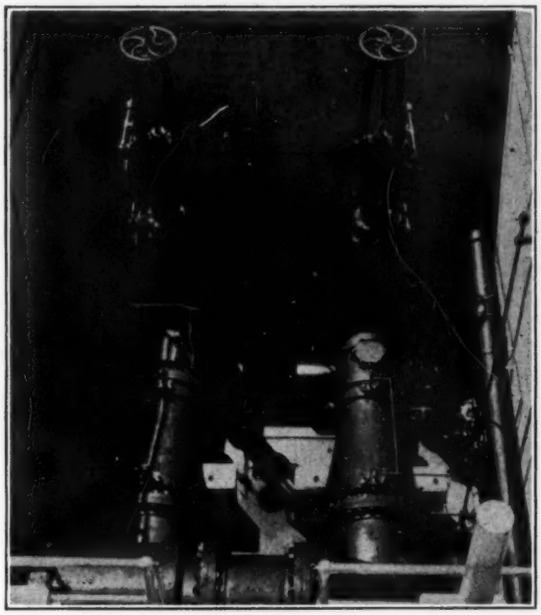
velocity and distributing the flow, a baffle is located in the settling tank out 9 feet from the face of the ports. The baffle is made up of 2-inchx12-inch redwood timbers dropped into adjustable slots on the tank walls so as to form two vertical planes and so spaced in each plane that the flow space between each two boards in the first plane will be offset by the location of a board in the second plane, thereby changing the direction of all horizontal flow from the feed ports by the zig-zag passage through the baffles. A duplicate of this arrangement is located at the cross walk so that any unbalanced condition resulting from the influent end of the tank or developing at any point in the front half may be corrected before the liquor reaches the effluent weirs.

The effluent from these new primary tanks will be mixed with the effluent from the Imhoff tanks prior to application to the filters. The sludge is collected and pumped to two Dorr Multi-digestion units, later described under section 8.

6. Trickling Filters (Single or Two-Stage Operation)
(Single or Two-Stage Operation)

The secondary treatment is provided by 16 rock filters, 176 ft. in diameter and 7½ ft. in average depth. The design is largely based on the required B.O.D. removals rather than on the number of million gallons of waste to be treated. The aggregate used in the beds of these units is a hard limestone that was crushed to pass 3-inch round openings but retained on 1½-inch round openings, with at least 50% to be retained on 2-inch round openings, 5% tolerance being allowed; only 3% was allowed to pass 1-inch round openings. Loading, unloading and placing operations were rigidly restricted, and all fines were washed from the channels of the underdrains before the peripheral rings of the beds were filled. A continuous floor covering of Dickey Type M Underdrain Blocks were used, amounting to some 390,000 sq. ft. The concrete floor under the blocks was designed to give a slope of 6 inches on the maximum radius of the bed. All under drain blocks were laid so that the flow channels in the blocks would form continuously smooth channels terminating in a collection channel that follows the diameter of the beds. The collection channel was provided with a split tile cover supported on wall bearing clay tile in order that it could be used as an inspection gallery. No attempt was made to produce aeration of the bed by artificial means.

The filters are equipped with Dorr Rotary Distributors, said to have been the largest that had ever been manufactured when installed. The sixteen filters are grouped in four batteries of four units each, with a main distribution chamber serving each battery through its own separate feed line. This chamber is constructed as a feed well with four diversion boxes that are separated from the well by motor operated sluice gates that can be locally or remotely controlled. On one of the batteries a replica of this gate arrangement is provided on the battery feed box so that a vernier-like control to meet changing flow conditions can be obtained. The main control chamber and the individual battery head boxes take the place

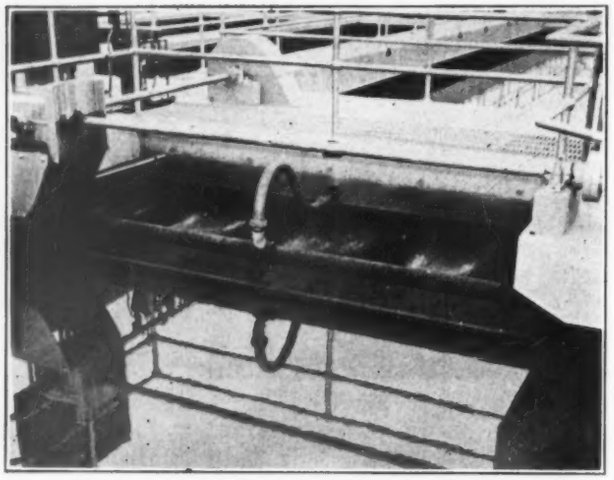


Meter Pit
These meters actuate the automatic proportioning control gates to the primary tank batteries

of the conventional siphon operated dosing chambers and thus allows the distributors to be fed continuously.

Each unit has a guaranteed uniform application per unit area when operating between 700 and 2200 gallons per minute. By increasing the size of the adjustable orifices the flow through each distributor can be increased to about 3200 gallons per minute, which will allow ample capacity for two stage treatment of all dry weather flows. This two stage treatment can be had by closing two motor operated sluice gates in the webb wall of the main distribution chamber, thereby dividing

The Chlorine Control Room
The dry gas feed unit in the center (capacity of 1000 lbs./24 hrs.) controls chlorine gas feed to the air-line to provide "aero-chlorination." See also the front-cover picture



Scum Collecting Water Sprays

For their functioning and removal of pocketed scum by automatic time-clock controlled dipping weirs—see text

it in two, and pcking up the effluent from the eight filters so loaded and returning it to the other side of the distribution chamber for feeding onto the remaining eight filters. Or, by simply leaving the webb-wall gates open and operating the return pumps, it will be possible to recirculate clarified and oxidized effluent to the main distribution chamber for diluting the mixed stale effluent from the primary units for single stage operation, if such proves the most effective of the three methods.

The arrangement of the filters together with the flow control provisions that have been included creates a splendid opportunity to further study trickling filter performance under three controlled conditions at various rates and B.O.D. loadings.

All gates are equipped with electrically operated hoists with local and remote bench board controls, allowing the operator at the control station to quickly adjust the number of units required to handle any flow condition. The filters were designed for flooding for psychoda control and provisions have been made in the piping arrangement whereby any possible ponding can be dealt with on a chemical control basis.

7. Final Sedimentation

The secondary sedimentation tanks are designed along the same lines as described for the primary tanks except that the skimming features are not included. There are three units (each 50 ft. x 150 ft. with 11 ft. water depth) equipped with Jeffrey sludge collectors of the chain and drag type. The tank overflow rate is 1000 gallons per square foot per day, based on the design figure. Weirs of V-notch design have been provided in H-Type arrangements to hold the take-off to 8 gallons per minute per lineal foot of weir. Baffles, feed ports and influent channels are of the same design as provided for the primary tanks described under section 5.

Three 200 g.p.m. Economy sludge pumps will return the thin settled material to the crude sewage for setting out with the coarse solids and, therewith, transferred to the digestion tanks.

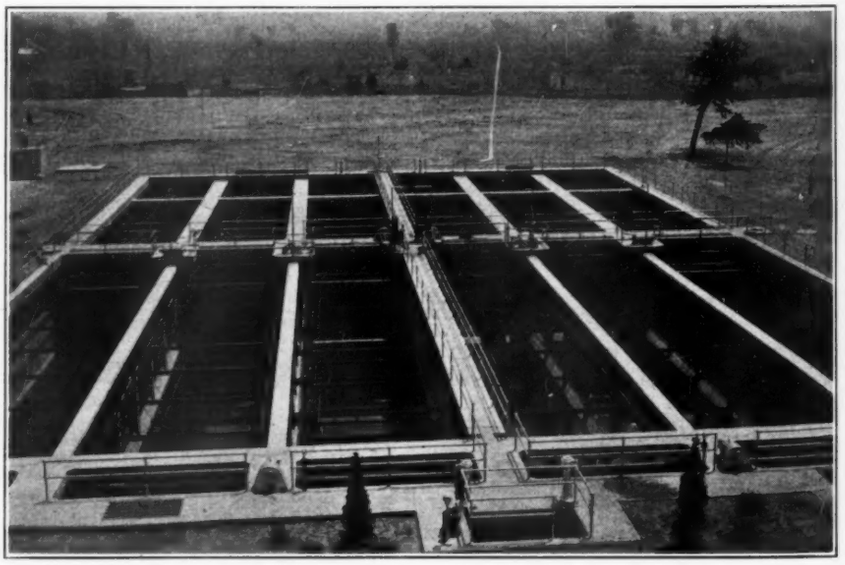
8. Sludge Digestion and Disposal

The present needs for sludge digestion are being met by the limited capacity (120,000 cu. ft.) provided in the Imhoff tanks, necessitating frequent discharging to nearby lagoons. On the basis of the digestion space available, Dallas is now obtaining a fair degree of sludge digestion on a per capita basis (industrial load included) with about 1/3 cu. ft. capacity which, in terms of some engineers, can't be done. The primary tank provided for relieving these Imhoff units will require separate digestion capacity and this has been set up. Two digesters each 85 feet in diameter by 30 ft. sidewall depth, exclusive of depth of the inverted cone shaped bottoms and equipped with Dorr Multi-stage Turbo-Digestion equipment, will handle the primary tank sludge that will be delivered by two 500 gallon per minute Chicago "Screw-Peller" sludge pumps equipped with Reeves Vari-Drives, and also will handle such sludge drawings from the Imhoff tanks as may be considered desirable. The primary digester will be heated with water drawn from two Bryant sludge-gas heaters. The gas will be collected under the floating type gas holding secondary digester dome, and will be used for general hearing purposes only. All excess gas will be burned as waste. Cheap fuel and low power rates in this area make it false economy to try to utilize the waste gas for power generating purposes at this time, and particularly so when the power company's standby connection charge is included in the cost of the power to be generated and used in the plant.

At Dallas Imhoff sludge has been satisfactorily lagooned for about 10 years and this practice will be continued as the final step in sludge disposal. The digester supernatant will be returned to the front end of the plant.

9. Recirculation of Effluent

Mention of effluent recirculation has already been made under "Trickling Filters," but one or two points can be added for the sake of clarity. The recirculation pumps are housed above a pump pit at the effluent end of the final tanks and are to be used only when and as required for additional treatment over and above that obtainable by the less costly single stage gravity flow



The New Primary Tanks, Supplementing the Old

Note that sludge scrapers draw from both ends of the tanks to the center sump, thus reducing strain and wear on the chains and drive mechanisms located on the center walk

through the sixteen filters. The operator will have a choice of (1)—two stage treatment (with or without about 40 minutes of sedimentation between stages); (2)—straight gravity flow through the sixteen units; (3)—returning up to 100% of the effluent from the final tanks to the settled sewage for dilution and freshening. These operations can be selected by simply setting a valve and gate sequence on a bench board in the control house and awaiting the necessary interval required for the electrical hoists to open or close the waterways. The pumps have adequate capacity to return the entire dry weather peak flow. The capacity is divided between 3 units: one 5 MGD, one 10 MGD and one 20 MGD.

Control of the water level in the pump pit was obtained by attaching a trend switch to an electrically operated gate that separates the pump-pit from the effluent channels of the final tanks.

The pumps are of the vertical mixed-flow design and were manufactured and furnished by the Pomona Pump Co.

10. Laboratory and Administration Building

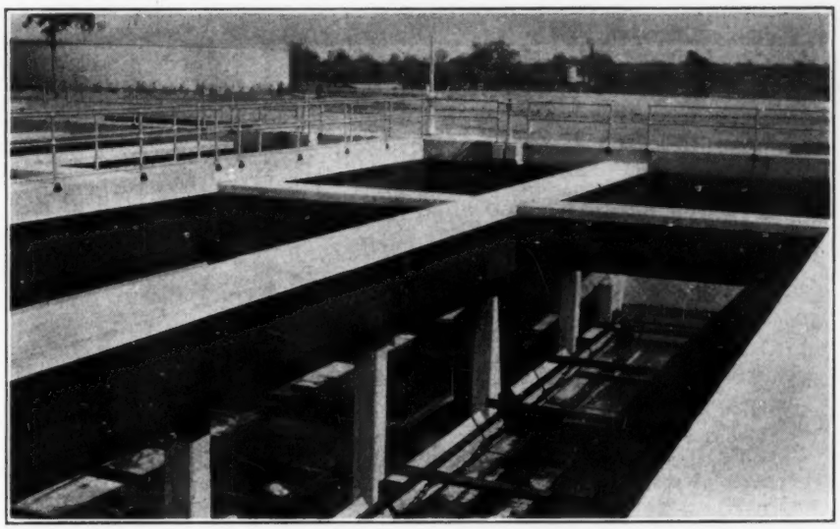
Complete chemical and bacteriological control tests will be made daily and microscopical examinations will be made from time to time. All salient features of a modern sewage treatment laboratory have been considered and provided in the laboratory layout and all needed equipment has been included. Cabinets, tables, hoods and cases were manufactured and furnished by E. H. Sheldon & Co. Temperature control equipment for the B.O.D. constant temperature room and the sample cooling box was supplied by Carrier Engineering Co.

The floor plan of the building includes the main laboratory, a constant temperature room, a balance and microscopic room, a sterilizer-autoclave room, a stock room, chemist's office, superintendent's office, and library, a record room, a general utility room, a wash room, the necessary storage closets and two corridors.

The laboratory will be operated during one shift only but hourly samples will be taken and placed in the sample chilling box for compositing in the laboratory. Composite samples will be compounded on the basis of the flows prevailing as recorded on the metering chart.

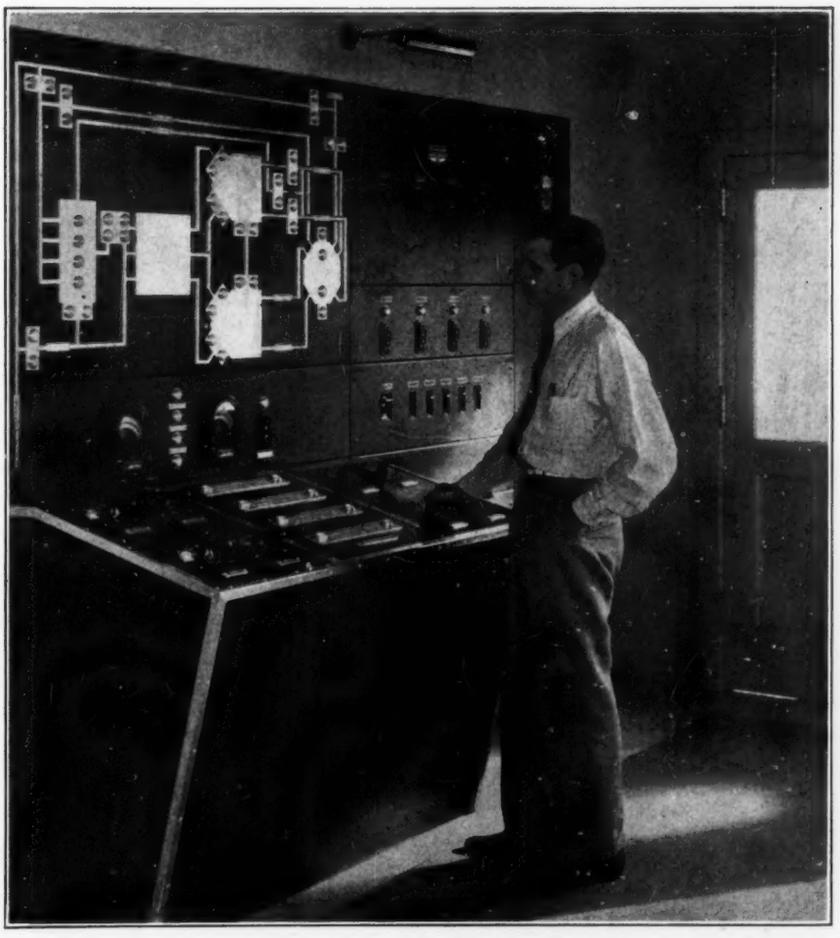
11. Operation and Control

The plant has been designed with the thought in mind that a sewage treatment plant can be made a desirable place to work. The equipment is as nearly automatic and as completely



Effluent End of Primary Tanks

Employing H arrangement of V-notch weirs



The Main Control Board
(At the "Throttle"—W. L. Powell, Operating Supt.)

Note mimic piping layout and valve position indicator lights. In the center of the bench-board are the sequence indicating lights to show the complete sequence of all operations, involving 15 gates or valves controlling flow to various plant units—notably the filters. At every routine operating point where practicable motor operated equipment has been employed.

electrically or hydraulically controlled as good practice will allow. All valves and gates of sizes above 30 inches that enter into the normal routine operation have been provided with mechanized operators, each with a locally and a remotely controlled station. All electrical hoists and controls for gates and valves, and all control boards, were furnished by Cutler-Hammer of Milwaukee. Gas and water-tight control cases have been specified for the entire job.

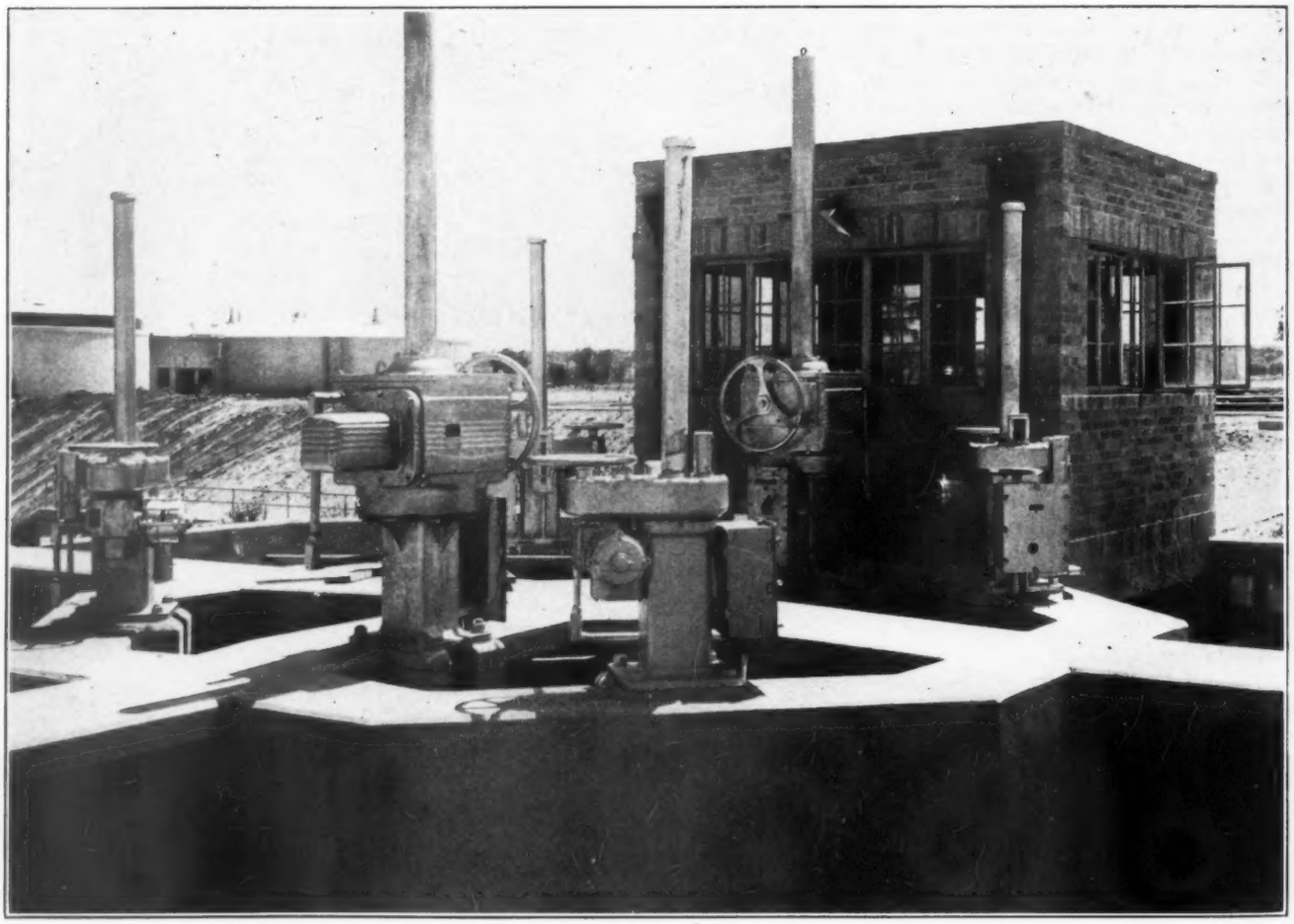
Time clocks have been freely used for pre-determined interval operation. By such a procedure, operations and functions can be made exact and definite and the human error eliminated as nearly as possible. Although the design represents an attempt to avoid over-mechanization, it has not neglected to include a motor everywhere a motor could be used to lighten the laborer's burden. This can probably be better explained in terms of figures: there are 77 motor operated and 5 hydraulically operated units that enter into the daily routine operation.

12. Design Basis

The present average dry weather flow is 20 million gallons per day, the peak rate being at 32 M.G.D. The design provides for complete treatment for an additional 25% of the present dry weather flow, or 25 mg. daily. The Dallas sewage carries a heavy load of industrial waste, its strength being indicated by an average 5 day B.O.D. of 350 ppm. and suspended solids content of 400 ppm.

The design has not been influenced by the usual practice of building for the long time needs of the distant future, based on a metropolitan growth curve that might not apply as intended. The reasons for this are multiple, a few of which are: (1) hydraulic structures function most satisfactorily while operating under the optimum conditions of flow and it is our opinion that such cannot be had when designs are projected far into the future and based on flows that are not attainable; (2) money invested in structures and equipment in excess of the present need is a costly procedure in terms of interest paid and should be held to the minimum; (3) equipment suffers depreciation and requires maintenance without giving back adequate returns; (4) treatment methods may be discovered or developed in the near future that will render present equipment obsolete. However, the design has been so laid out that additional units needed to increase the capacity can be provided. The expensive trickling filters have loading possibilities that have not fully been determined and it is entirely possible that the Dallas filters, with but minor changes, will be adequate to serve the needs of the city and its industries for many years to come. The auxiliary chemical feeding equipment can be used to lessen the filter loadings when and if additional treatment measures should be required during limited seasonal periods in the future.

The plant has cost the City of Dallas and the Federal Public Works Administration $1,535,000. Such constitutes an average per capita cost of slightly more than $3.00 when calculated on the basis of the total organic load. This figure would have been lower if the whole plant could have been completed under one contract.



Main Control Chamber for Feeding Filter Batteries

A local control bench is located in the small "Filter House." For the flexible functioning of this Distribution Control Chamber, see text. The two 48x96-in. gates make possible filter operation to provide two stage treatment.

Actually six separate contracts were required to complete the project.

13. Landscaping and Grading

The plant site has been brought to grade, provided with drainage, sodded and planted. Those of us who have been associated with the plant throughout its design and construction, are of the opinion that many people (and most especially the school boys and girls that will soon be tax-payers) will be sufficiently interested to visit the site and learn something of the principles of the operations involved. On this score the grounds should be attractive and capable of making a favorable impression. By spending ½ of 1% of the entire plant cost for this item, we have endeavored to lay the groundwork toward that end and having made the initial start we intend to follow it up in a most persistent and thorough-going manner. We want out-of-town visitors to come to our new plant, for we fully appreciate the fact that an exchange of ideas is one of the surest ways to promote knowledge and progress.

As we go from the design stage into the operating stage we find ourselves of the opinion that the plant offers an opportunity to make many studies and that probably the data compiled from such studies, together with the results of routine plant operation, may prove of interest to the readers of this article. If this be true we hope we will be allowed to come back to these columns at some future time with facts and figures on operating results as developed at Dallas.

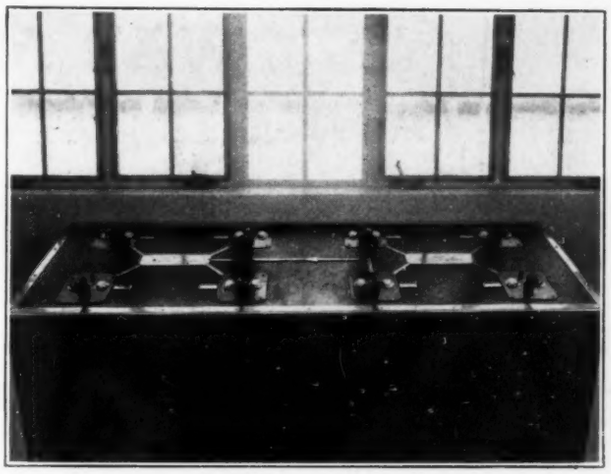
Contractors and Sub-Contractors

The following contractors, all of Dallas, were the successful bidders on the six separate contracts:

1. Vilbig Bros., Inc.
2. Central Contracting Co.
3. Southwest Stone Co.
4. Gifford-Hill & Co., Inc.
5. Williams & Whittle, Inc.
6. McClure Electric Co.

Manufacturers and sub-contractors supplying items of major equipment were the following:

Bar Screens—Link-Belt Co.
Grit Equipment—Link-Belt Co.
Sludge Collectors—Jeffrey Mfg. Co.
Sludge Digestion Equipment—The Dorr Co.
Sludge Pumps, Primary—Chicago Pump Co.
Sludge Pumps, Secondary—Economy Pump Co.
Sluice Gates—The Mueller Co.
Gates Valves—The Mueller Co.
Electrical Gate and Valve Controls and Hoists—Cutler-Hammer, Inc.
Electrical Control Boards—Cutler-Hammer, Inc.
Water Heaters for Digesters—Bryant Heater Co.
Recirculation Pumps—Pomona Pump Co.
Miscellaneous Pumps—Fairbanks, Morse & Co.



Filter Control Bench

From this central point distribution of flow to batteries and distribution to each individual filter is controlled

Blowers, Low Pressure—Roots-Connersville Blower Corp.
Filtro Plates—Carborundum Co.
Chlorinators—Wallace & Tiernan.
Dry Feed Machines—Wallace & Tiernan.
Flow Metering and Control—Simplex Valve & Meter Co.
Laboratory Cabinets and Hoods—E. H. Sheldon & Co.
Constant Temperature Apparatus—Carrier Engineering Co.
Laboratory Apparatus—Green Bros., Inc.

Personnel:

The plans and specifications for the plant were prepared by the Department of Public Works. All inspection work was also done by the department.

The design staff under the direction of the author included the following members:

W. L. Powell—Hydraulic and Structural.
F. K. Piggott—Structural and Mechanical.
C. R. Burtner—Structural.
John Fies—Electrical.
C. H. Blake—Architectural.

A. E. Wood was resident engineering inspector for P.W.A. Wm. Grant was examining engineer in charge of the docket for P.W.A. for the first part of the job. J. H. Gehbauer served during the latter part.

Operation:

The plant will be operated by the Water Department, under the direction of J. B. Winder, Director of Water Works and Sewage Disposal. The author will be actively in charge of the plant and W. L. Powell has been made Operating Superintendent.

War and Water Supply—Parisians Warned to Watch for Blue Water, Indicating Contamination of City Supply by the Enemy

Elsewhere in this issue is an account describing to some extent the preparedness program in England against the disruption of public water supply, as the result of aerial bombardment or other ravages of war.

In this same direction we learn that Paris has devised an added precautionary measure for use as an immediate warning and a continuing reminder to consumers that the water supply, or some part of the Paris supply, has been dangerously contaminated or poisoned by the enemy or their agents. In this respect particular concern is being felt over the work of Germany's or Italy's "fifth column" or the socalled "Trojan horsemen" within the gates.

The public in Paris has been warned against drinking or culinary use of water that may issue at any time from faucets with a blue or green tint. Chemists analyzing hourly samples from the several sources of Paris' water supply will order a blue or green dye pumped into the mains when there appears any evidence that the supply has been chemically poisoned or bacterially contaminated by agents of the enemy.

WAR MEASURES

In Protecting Britain's Water and Sewerage Services

By JOHN S. TREVOR
MIDDLESEX, ENGLAND

FOR the last two years the people of Great Britain have lived in the shadow of a new Armageddon, which now, unhappily, has taken on the hideous substance of reality. During those two years of War of Nerves a great deal was done by municipal authorities and public utilities responsible for the maintenance of vital water and sewerage services to ensure that these would not be interrupted should hostilities break out and open towns be subjected to aerial bombardment. These measures were speeded up as the result of the September, 1938, crisis, and the Government spared no effort to impress on all responsible executives the great urgency of completing the precautionary work then in progress. When war finally broke out on that fateful first Sunday in September, the precautionary measures were in an advanced state of preparedness and during the first three months of war these were largely completed, in spite of the additional heavy burden placed on all undertakings to comply with the Government's A.R.P. (Air Raid Precautions) requirements.

Naturally, the cost of protecting the nation's water and sewerage services has been a heavy one and it has just been revealed that one undertaking alone, the Metropolitan Water Board, spent over £400,000 on means to assure the maintenance of its services. No definite figure is available for the whole of Great Britain, but several millions must have been expended on work, which although a national necessity, cannot be regarded as likely to earn extra revenue. The heavy drain on the resources of the various municipal concerns and private companies is very serious and is by no means fully met by grants allowed under the Civil Defence Act.

The main problems facing the water and sewerage undertakings in Great Britain may be classified as follows:

1. Protection of key points, such as pumping stations, power houses, control centres, laboratories, etc.

2. Maintenance of supplies in an

Somewhere in England—An Emergency By-Pass Crew at Drill.
Photo shows the Victaulic A.R.P. System by-passing pile of debris. Crews wearing masks are drilled in such installations under all conditions.

emergency, which includes temporary and permanent repair of damaged pumping stations and power houses, burst water mains, sterilisation of contaminated water, etc.

Sandbag Protection

Although it is not possible to afford protection for large areas of works, it is realised that if key points are well protected, interruption of services is not likely to be lengthy. The most general method of protecting buildings is by means of sandbags, now all too familiar to residents of Great Britain. The Army standard pattern sandbag measures 33 ins. by 14 ins., empty, and it is made of jute bagging; average weight about 6 oz. per bag. Many of the large public undertakings laid in a stock of rot-proofed sandbags before war broke out and these have since proved extremely useful. The most effective method of rot-proofing is by treating the jute bags with a 15% solution of copper naphthenate in white spirit. Sandbags are three-quarter filled with sand, (dry earth when sand is not available) so that when beaten with a shovel to a rectangular shape they measure about 20 in. by 10 in. by 5 in. A sandbag is said to be a "stretcher" when it is laid with its longer side parallel to the face of the wall, and a "header" when at right angles to the face. The bond used in sandbagging is known as English bond, i.e. alternate courses of "headers" and "stretchers," the first course being "headers." The latter are always laid with chokes (tied ends) inside. In building a wall, care has to be taken to break vertical joints. A filling party usually consists of three men—two holding and tying and one shoveling. Building parties generally work in pairs; the combination laying a minimum of 60 bags an hour.

As an extra precaution some engineers have recommended the strengthening of key buildings by means of heavy timber supports well able to take the extra weight of debris from floors above which have collapsed, either through a direct hit or shock. Windows have either been boarded up or covered with strong wire netting to prevent the glass from shattering.

Camouflage

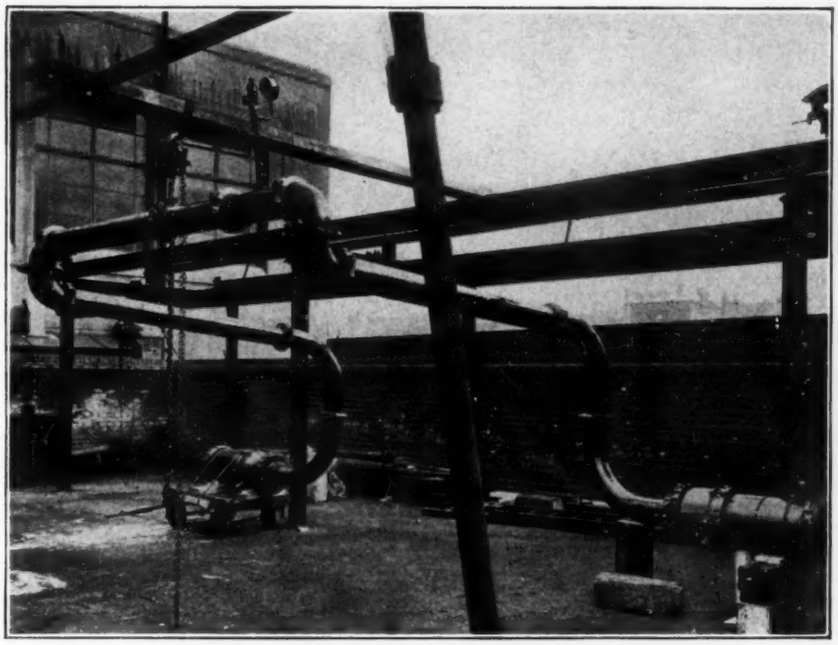
Closely associated with the protection of pumping stations, engine rooms, etc., is their camouflage. Although, of course, it is not possible to camouflage large expanses of water present in both water and sewerage works, the fact that adjacent pump houses, sheds, etc., are rendered inconspicuous tends to prevent the expanses of water from assuming their proper degree of importance. Incidentally, an attempt has been made to break up the highly reflective surface of a reservoir by floating on its surface a number of painted canvas covered rafts, but as far as the author is aware the method has not been generally adopted.

Effective disguise by camouflage is not achieved by painting trees and rural scenes on the roof and walls of buildings, but by the cunning use of bold patterns made up of highly contrasting colours. Those most commonly employed for camouflage purposes are red and green and the texture invariably matt. In practice all light surfaces, roofs and walls, are darkened to conform to the prevailing tone of the neighbourhood and light concrete roads are also treated with dark coloured paint. Various types of paints are in use: oil paints, oil-bound water paints, bituminous paints, silicate paints and cement paints. Bituminous paints are particuarly useful for treating concrete structures and roads.

Maintenance of Supplies In an Emergency

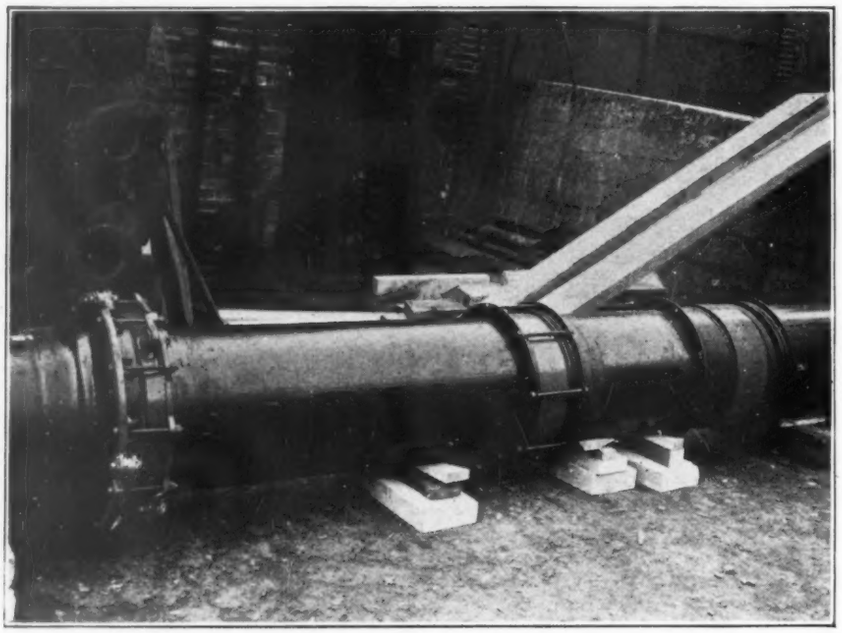
The second problem is naturally an extremely serious one which can only be properly solved by the use of special emergency plants and the close co-operation of highly skilled personnel with the local authorities responsible for fire fighting and A.R.P. In London and, indeed, most important towns throughout Great Britain, arrangements have been made for a turncock or his assistant to attend at each of the fire stations, in the region served by the undertaking, as soon as the public warning signal is given. These men know exactly what to do in an emergency and their prompt action is calculated to be of the utmost assistance in a raid. Repair gangs and sterilisation units are available for standing-by in case of a raid. Apart from the staff organised to deal with an emergency as far as it affects the supply of water, volunteer squads for firefighting, gas decontamination, demolition and rescue, first aid and ambulance, etc., are all available at pumping stations, administrative and control centres. Some important municipal concerns are spending considerable sums on patrols for the reservoirs and filter beds, etc., to guard against sabotage. The War Department is also cooperating in the guarding of key points. Eternal vigilance is the watchword of all British water supply undertakings during these anxious days of war.

Waterworks and sewerage workers from the age of 25 onwards (in some cases even younger) are exempt from military service as these occupations come under the heading of Reserved Occupations. In spite of this, however, some water undertakings report a shortage of skilled men owing to their migration to highly paid muni-



Emergency Victaulic A. R. P. By-Pass System

The complete unit was assembled and tested to 100 lbs. water pressure within 30 minutes, in the presence of about 150 Gas and Water Engineers and Government Officials, assembled in London.



A Fractured Water and Sewage Line Rapidiy Repaired.

Photo shows straight through arrangement incorporating plain ended steel pipes of the same outside diameter as the existing cast iron main, connected by means of A. R. P. Johnson Couplings. This straight through arrangement is practically suitable for sewage lines.

tion works. If this continues the consequences may be serious.

Emergency equipment has cost water undertakings millions of pounds to install and house, and in most cases it is only possible to obtain compensation from the Government to the extent of 50% of approved expenditure. Portable pumping plants are the most important item and one large undertaking, the Metropolitan Water Board, has expended £228,950 on this one item alone, apart from the cost of making connections for this plant at the various stations and the building of sheds to house the pumps. Emergency trailer pumps naturally vary in design, but are generally made to run between 2620 and 3150 r.p.m. and handle between 420-265 gallons per minute, at pressure varying from 60 to 120 lbs. per sq. in. Two discharge branches are provided and drive is by an engine of standard design with an R.A.C. rating of 12 B.H.P. Apart from portable pumps, mobile chlorinators have to be held in reserve. Two important types of apparatus are available, one making use of chlorine gas and the other utilising hypochlorite. Units usually comprise a small truck with a properly fitted trailer which is equipped with gas cylinders, chlorinator, pump, tools, spares, etc. A very well known outfit consists of a pump with V. belt drive from a ½ h.p. air cooled petrol engine. The hypochlorite solution tank is of welded steel construction with protective vulcanised rubber lining. At the maximum output and using 5% chlorine solution, the rate of feed is approximately 2.5 lbs. of chlorine per hour. Working with a dosage of 1 p.p.m. it is possible to sterilise a flow of water of 250,000 gallons per hour.

To make good damage done to important works, duplicate valves, etc., have to be stored ready for a possible emergency and in the case of the latest automatic control valves the cost is exceedingly high.

Supplementary Sources of Water Supply

Due to the encouragement of Government Departments and Local Corporations, many important water supplying companies throughout Great Britain have, during the last three or four years, taken a progressive step in providing alternative sources of supply, either by building new reservoirs or sinking Artesian wells and boreholes. Incidentally, an increasing number of industrial concerns have been sinking their own wells so as to ensure a reliable supply of water in case the public supply fails for any reason.

During 1938 a very thorough survey was carried out by the London County Council and other local authorities throughout the country to put on record all possible supplies of water which could be utilised in case of air raids, when it was presumed a large number of fires caused by incendiary bombs would break out simultaneously. In addition to the mapping of all rivers, streams, wells, public swimming baths and storage tanks of over 2000 gallon capacity, the work of providing canvas tanks, 1400 to 12,000 gallons capacity, and smaller sectional steel tanks was put in hand and has now been executed. These small reservoirs can be seen dotted about the streets and squares of London and the large provincial cities and they may be of the greatest possible value should it prove impossible immediately to secure adequate supplies of water from the mains. Incidentally, in London a fleet of water trucks is available for rushing water from the river to fire fighting centres. Also there are trucks specially equipped to unwind the miles of hose needed to pump supplies of water from the main rivers and canals.

Dangers of Burst Sewers In London

In London the closeness of main sewers, particularly the Fleet Sewer, to underground railways was fully realised by the authorities as soon as war broke out. Although supplies of water through the mains can be cut off by turncocks within an hour or so, it is not possible to prevent sewers from emptying their contents into the undergrounds (Subways to you—Ed.). Faced with the risk of tube stations becoming sumps and the railway lines being flooded ,the London Passenger Transport Board have installed a series of electrically operated floodgates at strategic points throughout their system. These gates, designed by Mr. W. T. Halcrow, M. Inst. C. E., consulting engineer, in conjunction with London Transport's engineers and built by Messrs. Glenfield and Kennedy of Kilmarnock, are of built-up steel on an overall thickness of 13 inches; each gate weighs a little less than 6 tons. The gates can withstand a pressure of 800 tons. By a clever automatic attachment, the greater the pressure of water inside the tunnel, the more watertight the floodgates become. In the event of the sewers being hit the only course is to pump out all flooded stations with auxiliary portable pumps, a large number of which are now available at fire stations.

All sewerage undertakings have in store considerable stocks of pipes and spares of all kinds so that the smallest possible delay is likely to be experienced in effecting necessary repairs. This is an insurance which may one day pay good dividends.

The proximity of sewers to water mains is a potential source of danger, as in the event of the sewers becoming damaged it is highly probable that water mains will be fractured and the supply thus become contaminated. The only way to safeguard water supplies is the prompt attention to all burst mains and the sterilisation of suspected water.

Repair of Damaged Mains

The most vulnerable part of all water systems suffering air bombings is the distribution piping and the vulnerability of mains is fully recognised by the authorities. Several types of emergency outfits are available, probable the best known being the Victaulic system developed and produced by the Victaulic Company Ltd., London, which has the approval of the Home Office. Its use renders the water supply undertaking eligible for a grant under Part V of the Civil Defence Bill. The Victaulic system for providing temporary water mains consists of an arrangement of 6 in. light gauge steel pipes with special flexible joints which may be fitted by unskilled labour at the rate of 2 minutes per joint. Lengths of piping in 12 ft. lengths, coupled with bends and elbows, enable any size bomb crater or pile of debris to be effectively bridged. The 6 in. pipe is connected to existing mains of any size by means of connectors reducing from the size of the main to the 6 in. temporary pipe and a special Victaulic closer joint is fitted to the plain end of the broken pipe. The other end of the closer joint is formed for a standard Victaulic joint which can take either the short reducer or straight pipes, as required. Fractured water and sewerage mains can be permanently repaired very rapidly by means of Johnson Couplings without central register, the damaged pipe being cut out and replaced with plain ended steel pipe of the same outside diameter. Where undue shock has caused spigot and socket joints to leak, an effective repair can be made by using a Johnson Clamp. This consists of a rubber ring held tightly against the face of the socket by means of a front flange which is secured to an anchor collar located behind the socket head. Both flange and collar are in segments for easy assembly. The adjustable type of clamp now being manufactured can be used on pipes varying by as much as 1 in. (up and down) for British standard diameters.

The prompt use of these repair outfits is assured as all large water and sewerage undertakings, and (the systems all being adaptable for sewerage lines) have trained repair gangs available day and night to deal with all emergencies. They can be rushed in specially equipped fast trucks to any part of the region covered by the undertaking, which, through its special contact bureau, is kept in the closest touch with all developments throughout a raid. A.R.P., fire services and the police keep in the very closest touch with these vital public services and rehearsals indicate that working co-operation is exceedingly close.

Handy Clamp for Aligning Pipe

The accompanying sketch gives the construction details of a very useful clamp for aligning pipes or bars which are to be joined by welding or brazing. It also has other uses, and its construction involves simple and easily obtained parts and but little work.

Construction: The clamp consists primarily of two parallel plates which are connected by welding a section of angle iron sufficiently long enough to support the ends of the pipe, or bar, about 6 or 8 in. back of the joint. The dimensions on the plan are for a clamp to be used on pipe up to about 3 in. diam. If larger sizes of pipe are being used, it will be necessary to increase the sizes of the angle iron, of the base plates and possibly also of the chains for holding the pipe in place.

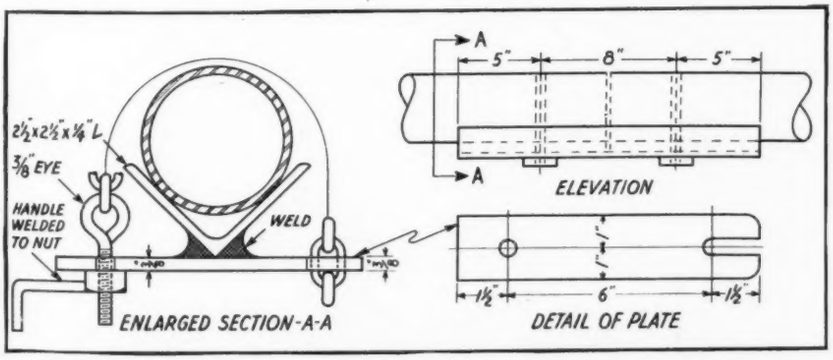
The angle iron is first welded across the face of the two plates. The ⅜-in. eyes in each end of the plates are then inserted in the holes and the chains drawn over the pipe and slipped into the slots so that the links bear on the underside of the base plates. Nuts are threaded over the eyes. A small piece of welding rod can be welded onto each nut to form a handle for quick operation of the clamp.

Adjustment: It is a simple matter to adjust this clamp on the ends of two pipes. The pipes can be spaced by laying an ⅛-in. or 1/16-in. diam. welding rod across the two arms of the angle iron and butting the pipe up against it, then fastening the aligning clamp in place so that the proper space is thus provided. The welding rod can then be removed and tack-welds made at three places on the pipe circumference. After the tack-welds are made, the clamp is removed and welding proceeds either by rolling the pipe or in position, as the situation requires.

Clamp in Use.

A modification of this clamp is shown in the photograph. This involves the use of two large C-clamp members in place of the chains.

[For the illustration used with this article we are indebted to "Acetylene Tips" of The Linde Air Products Co.—Ed.]



Construction Details of Alignment Clamp.

Cleaning Meter Casings By Sand Blasting

By W. R. LA DUE, Sup't & Engineer,
Bureau of Water
AKRON, OHIO

The use of sand blasting instead of acid dipping for cleaning meter casings being desirable, it was necessary to develop a chamber that can be used in the meter repair shop so that the work may be done without subjecting the men to silicosis. The attached print is a diagrammatic sketch of the chamber developed by the Bureau.

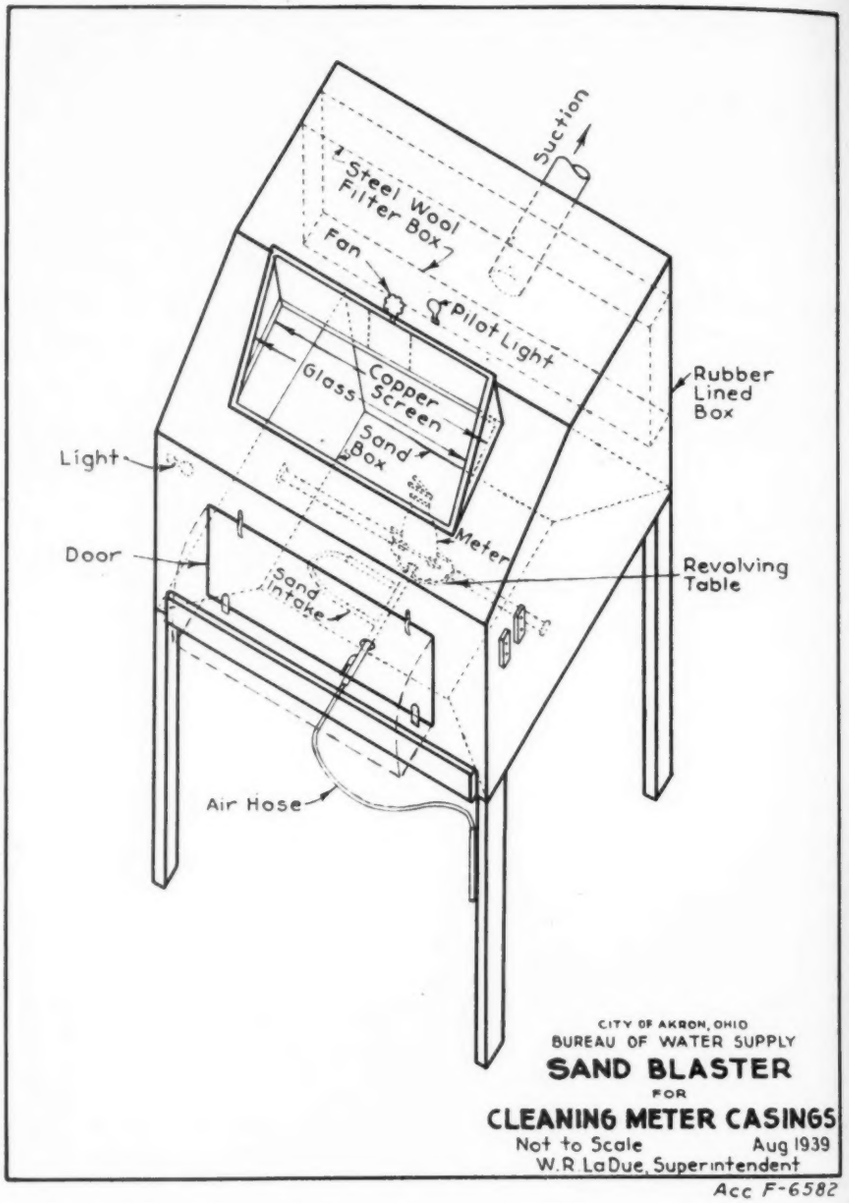
The meter is placed on the notched revolving table and revolved by inserting the end of the blast gun in the notches. As there is some play in the hole through which the blast gun enters the box, a vertical strip 2 inches wide may be cleaned before it is necessary to revolve the table.

The registers are removed before the casing is placed in the blaster and the bonnet glass and threads on the inlet and outlet are covered; thus no sand enters the casing and the glass is not etched. The cleaning of a ⅝-inch meter requires about three minutes.

The operator looks through the glass window, the glass being protected by a fine mesh brass screen which keeps sand from etching it. He can see his work at all times while blasting, as the inside of the box is lighted.

The sand placed in the bottom of the blaster is drawn up by the blast gun, which is really a water siphon. In changing this water siphon to a sand blast gun, the designers have worked up a jet that can stand the brunt of sand passing through the nozzle with very little wear, even though the sand travels under 60 or 70 pounds air pressure.

The box is kept free from dust by a suction fan. The suction to the fan passes through steel wool that screens out the coarse sand particles, which drop to the bottom of the blaster and are used over again.

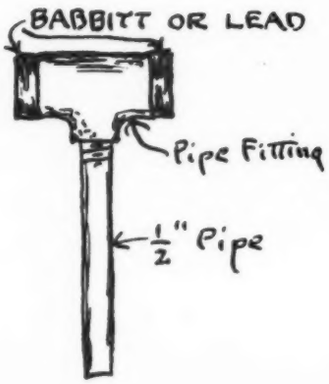


After meters are blasted, they are given a coat of clear lacquer, which gives all meters a uniform finish. Bottoms are painted black.

Easy to Make a Soft-Hammer

Here is a useful and easily made soft hammer—shown in the accompanying sketch. It is nothing more or less than an ordinary standard "Tee" pipe fitting and a half-inch pipe. The former, when filled with lead or babbitt, serves as the hammer head, and the latter is the handle.

For pouring, moulds are unnecessary. Simply wrap paper around the rim to form the face of the hammer and to keep the lead from spilling when the metal is poured. Nor is it necessary to fill the Tee entirely full of molten metal; it may be filled mostly with pieces of scrap metal or anything non-combustible to fill the space. Scrap pipe plugs, for instance, are good fillers.



A hammer like this can be made in almost any desired weight because there are so many standard sizes of pipe fittings. One made by the writer weighed about four pounds.

For striking and driving bolts, nuts, shafts, pipe, and similar machine parts that must not be scratched or battered there is nothing better than a soft lead or babbitt-faced hammer. Rawhide-faced hammers and wooden hammers do not scratch or batter, but they usually are not heavy enough for quick performance.

*Contributed by W. F. Schaphorst, M.E., Newark, N. J.

THE SOFTENING PLANT OF THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

To Provide Lime-Zeolite Treatment and Filtration

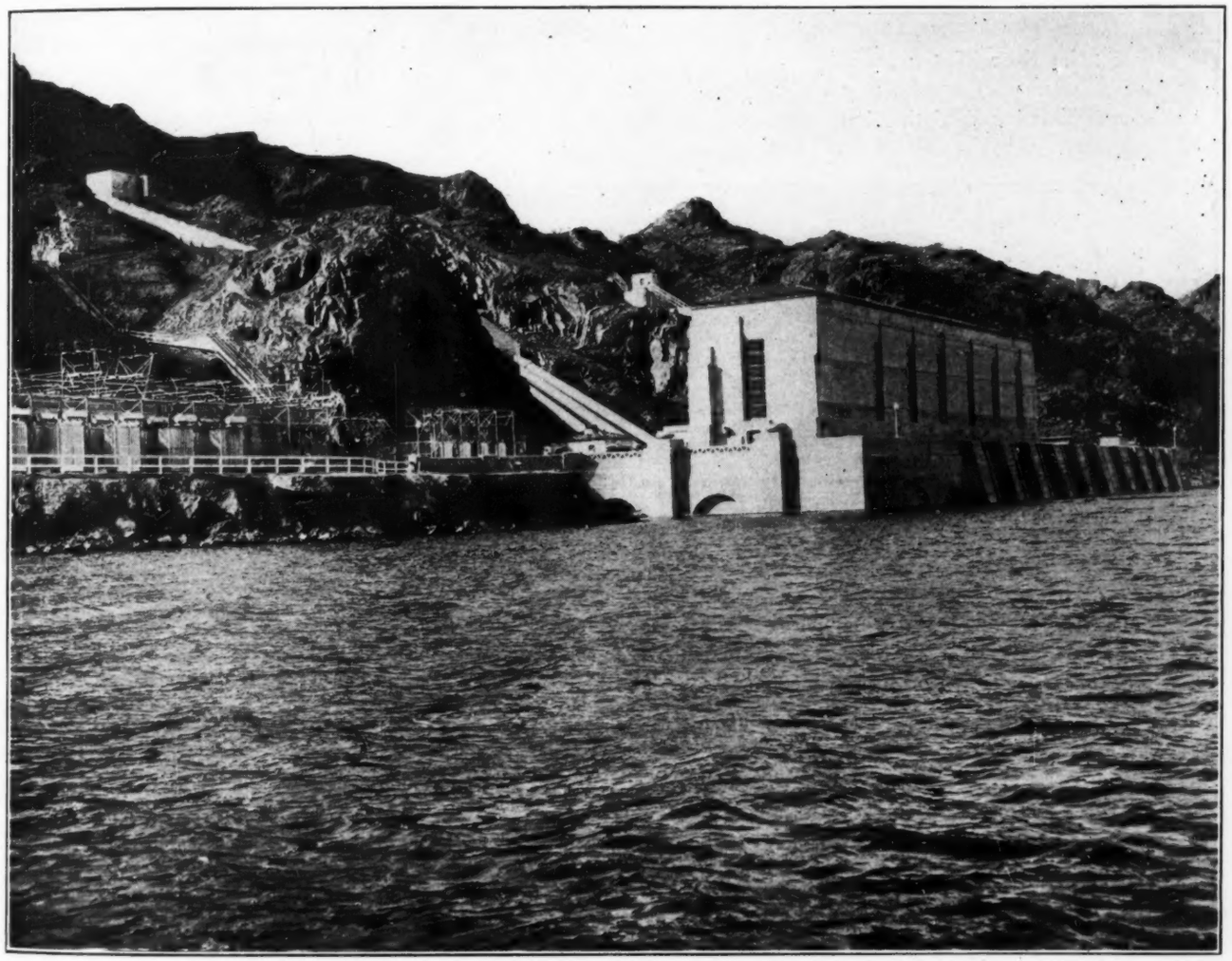
1—Method of Treatment

(The First of Three Articles)

By CHARLES P. HOOVER,* J. M. MONTGOMERY,*
W. W. AULTMAN†

NOT later than the spring of 1941 The Metropolitan Water District of Southern California will begin delivering Colorado River water to its member cities (Anaheim, Burbank, Beverly Hills, Compton, Fullerton, Glendale, Long Beach, Los Angeles, Pasadena, San Marino, Santa Ana, Santa Monica, and Torrance) through its recently constructed aqueduct system. The Colorado River Aqueduct, including Parker Dam, five pumping stations, and miles of canals, conduits, siphons, tunnels, and power transmission lines, is one of the greatest engineering and construction projects ever undertaken. Its construction was made necessary by the rapid growth

* Hoover and Montgomery, Consulting Engineers, Columbus, Ohio.
† Engineer, The Metropolitan Water District of Southern California, Los Angeles, Calif.



Source of the Supply of the Metropolitan Water District

Intake and Pumping Station above Parker Dam on the Colorado River 155 miles below Boulder Dam. Here the water is lifted 291 feet to travel almost 280 miles to the 100 M.G.D. Softening and Filtration Plant located 30 miles East of Los Angeles. Ultimately this plant will be enlarged to a 400 M.G.D. capacity to supply 13 cities

of Southern California and by the certainty of a continuation of that growth in the future.

Southern California is a semi-arid region, with neither sufficient rainfall nor large enough drainage areas required to support large industrial cities. In the exhaustive development of underground water supplies such resources are being depleted rapidly, in spite of the fact, that since 1913 the City of Los Angeles has been "importing" water for most of its needs through its aqueduct from the far off Owens River. With the placing in service of the Colorado River Aqueduct, California's south coastal plain will be assured of an abundant and inexhaustible supply of water.

In order that the suply might be not only abundant but of high quality, the District is building a water softening and filtration plant near the town of La Verne, approximately 30 miles east of Los Angeles. Construction has been under way since the latter part of 1939 and the plant is scheduled for completion on January 15, 1941.

Quality of the Raw Water

From analytical records of the U. S. Geological Survey dating back to 1925, and from studies on the operation of Boulder (Hoover) Dam by the U. S. Bureau of Reclamation, and from other available data, it has been possible to calculate the probable average, minimum, and maximum hardness of the water which will have to be handled in the plant. The anticipated long-time average analysis of Colorado River water is as follows:

	Parts per million
Calcium	81.
Magnesium	25.
Sodium and Potassium	87.
Bicarbonate	182.
Sulfate	243.
Chloride	60.
Nitrate	2.8
Iron	0.25
Silica	19.
Fluorine	0.3
Boron	0.15
Total dissolved solids	609.
Hardness at $CaCO_3$	
Total	305.
Carbonate	145.
Non-carbonate	160.

Free carbon dioxide, 6 p.p.m.; Hydrogen ion concentration (pH) 8.0.

Selection of Softening Method

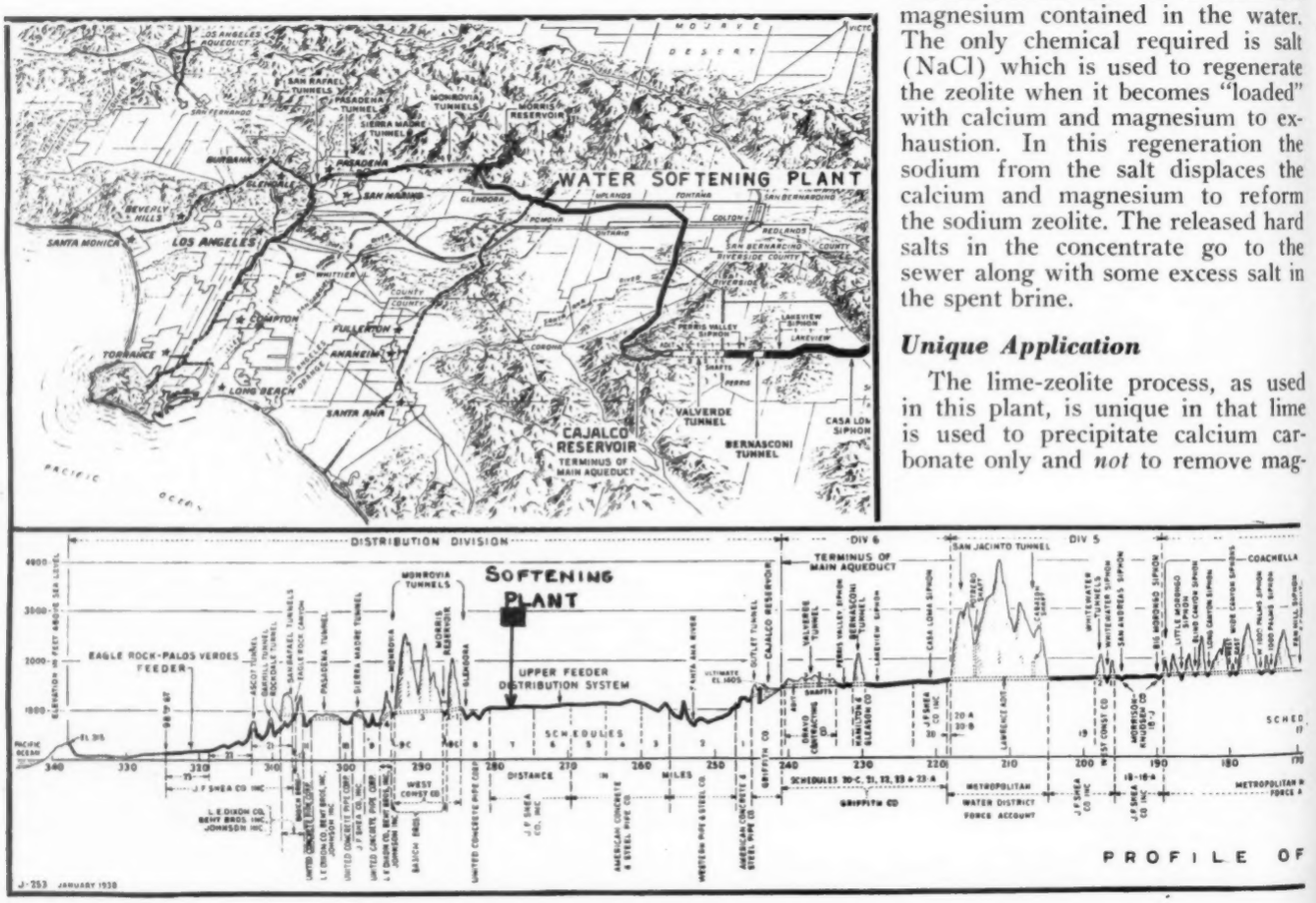
The lime-zeolite process was chosen as being the most suitable for softening Colorado River water only after a complete study was made of this and all other processes, of the availability and costs of softening chemicals. Many softening processes and schemes were suggested but the only ones which were given serious consideration were the lime-soda, all zeolite, and lime-zeolite processes. Others were discarded as being either too expensive or too experimental, or both.

The lime-soda process, involving the use of lime and soda-ash, was developed for the softening of hard magnesium waters and is familiar to most water works chemists. Lime is added in sufficient quantity to combine with the free CO_2, the bi-carbonate hardness and the magnesium, with enough excess to raise the pH to the point where most of the magnesium will be precipitated. Soda ash is then added to reduce the non-carbonate calcium hardness to the desired point. The excess lime is neutralized, usually with carbon dioxide gas, after the magnesium has been removed. The essential chemicals are lime, soda ash, and carbon dioxide.

The zeolite process makes use of a base exchange reaction for softening. Hardness is removed by passing water slowly through a bed of zeolite, which is a prepared mineral having the property of exchanging its sodium content for the calcium and magnesium contained in the water. The only chemical required is salt (NaCl) which is used to regenerate the zeolite when it becomes "loaded" with calcium and magnesium to exhaustion. In this regeneration the sodium from the salt displaces the calcium and magnesium to reform the sodium zeolite. The released hard salts in the concentrate go to the sewer along with some excess salt in the spent brine.

Unique Application

The lime-zeolite process, as used in this plant, is unique in that lime is used to precipitate calcium carbonate only and *not* to remove mag-



The 392 Mile Colorado River Aqueduct System in profile and partly in plan. To show

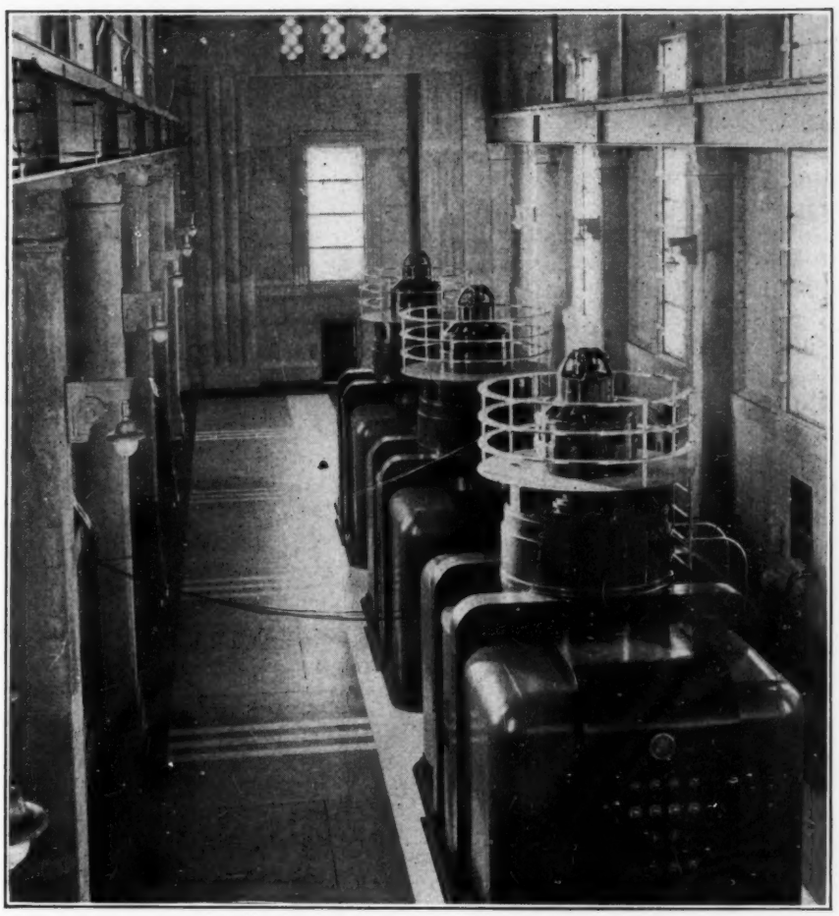
nesium. From the raw water analysis it will be seen that all of the carbonate hardness is due to calcium bicarbonate and that magnesium is present only as noncarbonate hardness. When lime is added in just sufficient quantity to combine with the free CO_2 and the calcium bicarbonate hardness, the reaction goes to completion quickly and practically pure calcium carbonate only is precipitated. Due to the fact that the precipitate contains little or no flocculent magnesium hydroxide, it takes a crystalline form, is heavy, and settles rapidly. After lime treatment, filtration, and final pH adjustment, a sufficient portion of the water is softened to zero through zeolite to reduce the hardness of the final combined effluent to the desired point. The essential chemicals are lime, salt, and carbon dioxide.

Concerning Costs

Based on present chemical prices, water works chemists know that for each part per million of hardness removed lime is the cheapest water softening reagent, salt is next, and soda ash is the highest of the three. That this relationship is true in Southern California is shown in the following table. The prices given for lime and salt are bid prices delivered at the softening plant. The soda ash price given is the lowest quoted when comparisons of plant operating costs were being made. The amount of salt required is based on the expected use of 0.35 lbs. per 1000 grains of hardness removed.

Using the lime-soda ash process, only that part of the lime which combines with the free CO_2 and with the carbonate hardness accomplishes any softening. That required to remove magnesium and to raise the pH does not reduce the hardness. With this process, lime costs are therefore greatly in excess of those indicated in the above table as being required for actual softening. The remainder of the process, the removal of noncarbonate hardness, involves the use of soda ash, the most expensive chemical in the list.

The zeolite process requires the use of salt for the removal of both carbonate and non-carbonate hard-

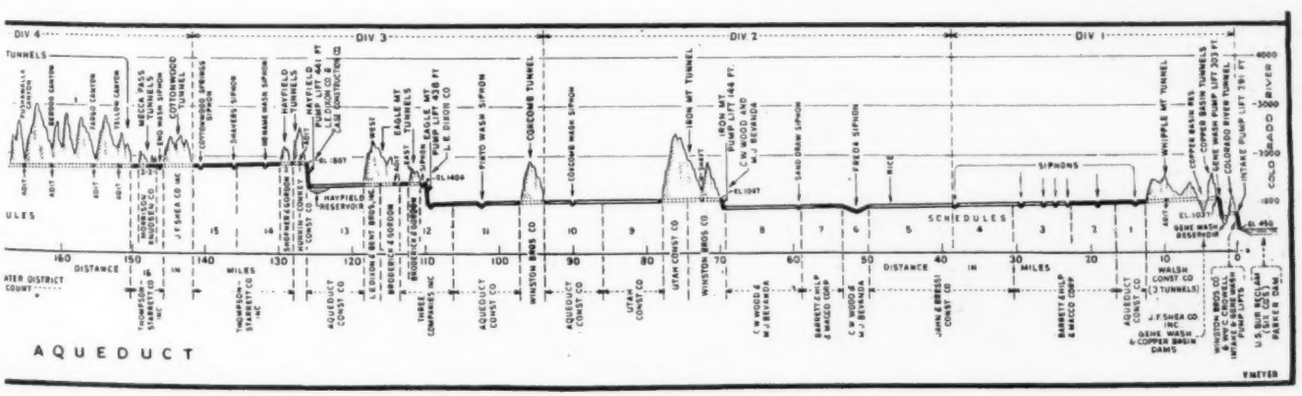


Motor Floor of One of Five Pumping Stations Located Along the Line of the Metropolitan Aqueduct

(Each pump has a capacity of 90,000 g.p.m. At the Parker Dam, these single stage pumps lift 291 feet, to set a precedent in pumping practice.)

COMPARATIVE COSTS OF WATER SOFTENING CHEMICALS

Reagent	*Lbs. Required to Remove 1 ppm from 1 M.G.*	*Cost of Chemical per Ton*	*Cost of Chemical per lbs.*	*Cost of removing 1 ppm from 1 M.G.*
Lime (100% CaO)	4.66	$ 6.25	$.003125	$.01456
Salt at 0.35 lb./kgr.	20.40	4.55	.002275	.04641
Soda ash	8.80	16.50	.00825	.07260



the location of the purification plant and area served.

ness. For this reason it cannot when taken alone compete in chemical cost with the lime-zeolite process which uses inexpensive lime to remove an important portion of the hardness.

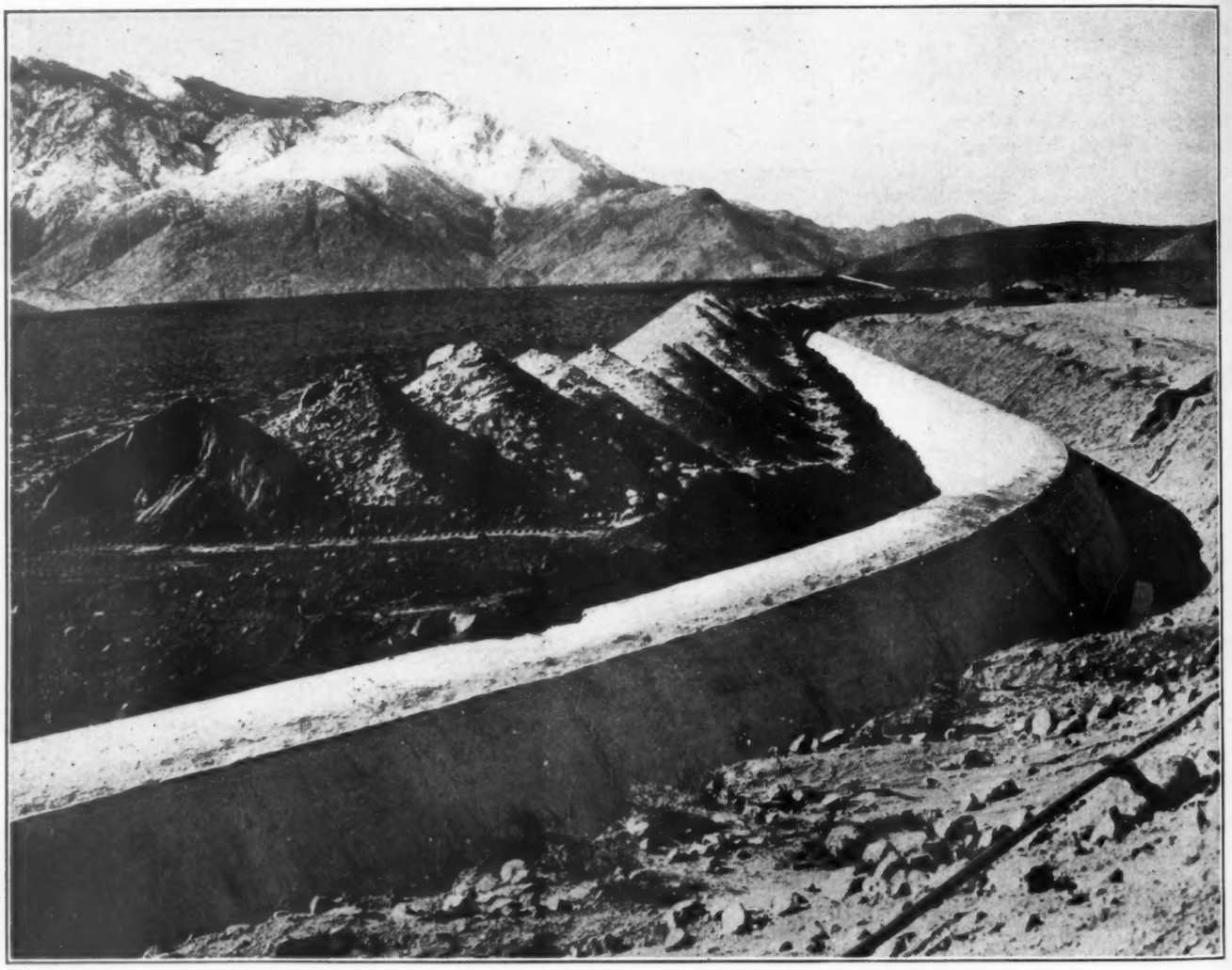
Lime-zeolite treatment gives the lowest chemical cost of the three processes studied. Less lime is required than for the lime-soda ash method because only the theoretical amount for combining with the free CO_2 and the calcium bicarbonate hardness is used. For the removal of non-carbonate hardness, salt is the chemical actually used and it is less expensive than soda ash.

In selecting the process to be used, other factors than chemical costs must, of course, be given full consideration. Actual costs of the major chemicals per million gallons, using the three processes, are shown in the following table. Costs are based on softening average Colorado River water to produce a finished water of 85 p.p.m. total hardness.

Softening reagent	*Constituent to be removed And quantity in P.P.M.*		*Lbs. per M.G. (100% reagent)*	*Cost per ton**	*Chemical cost per M.G.*
	LIME-SODA ASH PROCESS				
Lime	Free carbon dioxide as CO_2	6	63.4	$ 6.25	$ 0.20
"	Carbonate hardness as $CaCO_3$	145	677.6	"	2.12
"	Magnesium as Mg	25	480.7	"	1.50
"	Excess to raise pH as $CaCO_3$	35	166.9	"	0.52
	Non-carb. hardness as $CaCO_3$	160			
Soda-Ash	Non-carb. hardness removed as $CaCO_3$	110	397.5	16.50	8.03
	Total cost of lime and soda ash				$12.37
	ZEOLITE PROCESS				
Salt	Hardness removed by zeolite as $CaCO_3$	220	4596.	$ 4.55	$10.46
	Total cost of salt				$10.46
	LIME-ZEOLITE PROCESS				
Lime	Free carbon dioxide as CO_2	6	63.4	$ 6.25	$ 0.20
"	Carbonate hardness as $CaCO_3$	145	677.6	"	2.12
	Total hardness after lime softening as $CaCO_3$	195			
Salt	Hardness removed by zeolite as $CaCO_3$	110	2248.0†	4.55	5.14
	Total cost of lime and salt				$ 7.46

† Salt requirement 0.35 lb. per 1000 grains of hardness removed.

* Cost per ton of 100 cent CaO lime on basis of $5.50 per ton for 88 per cent CaO lime.



A Section of the 16 Ft. Concrete Conduit Across the Desert and Under Mountains
Capacity—Approximately One Billion Gallons per Day

Warm Weather Worries

Warm weather is conducive to that "Old Feeling", but unfortunately, water men are kept so busy with problems of water treatment that they usually cannot afford this luxury.

Increasing temperatures mean to the water works men a necessity for changing plant control conditions such as rate controllers, chemical dosages, etc., so that they usually cannot afford to become afflicted with the Summer doldrums. Warm weather also means increased growths of algae in water supplies, necessitating control with copper sulphate. Increased temperature also means a possible build up of tastes and odors in the water supply.

Many plant operators have adopted the use of AQUA NUCHAR Activated Carbon so as to minimize their warm weather worries. Plan now to secure an adequate supply of AQUA NUCHAR to correct the taste and odor conditions which are already on their way.

INDUSTRIAL CHEMICAL SALES

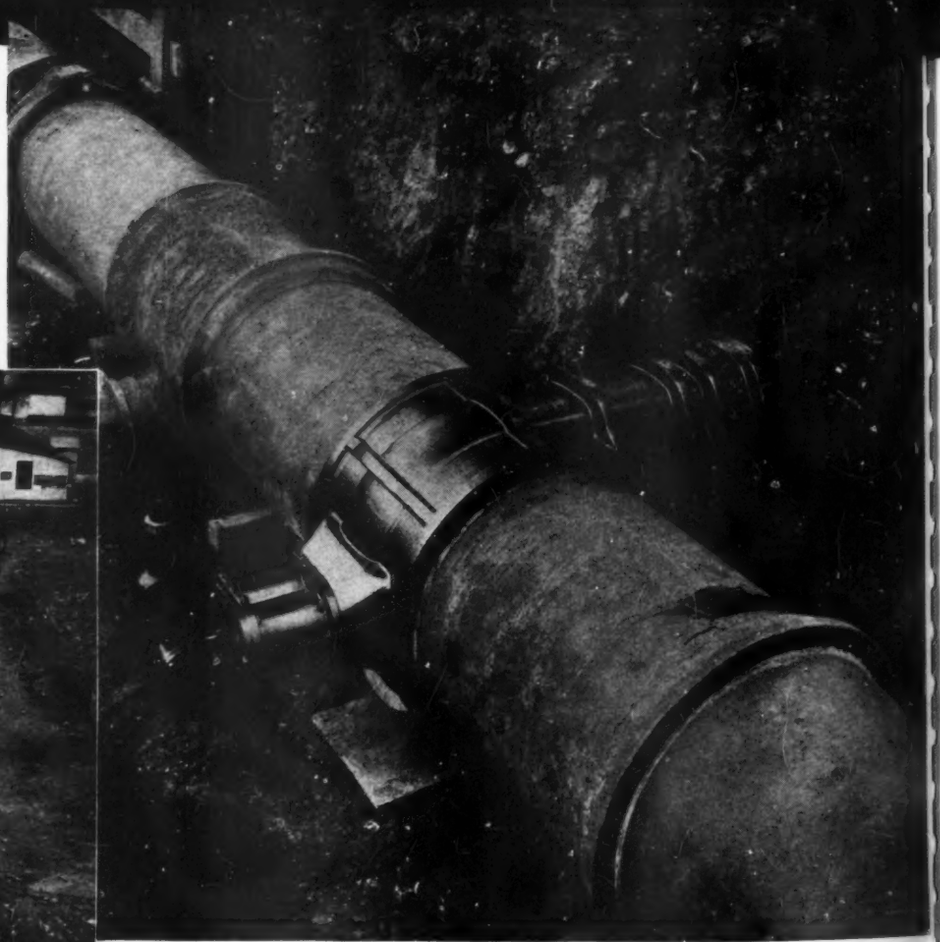
DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

NEW YORK CITY	CHICAGO	PHILADELPHIA	CLEVELAND
230 Park Avenue	35 E. Wacker Drive	1322 Widener Bldg.	417 Schofield Bldg.

Manufacturers of NUCHAR ***Activated Carbon***

READING R

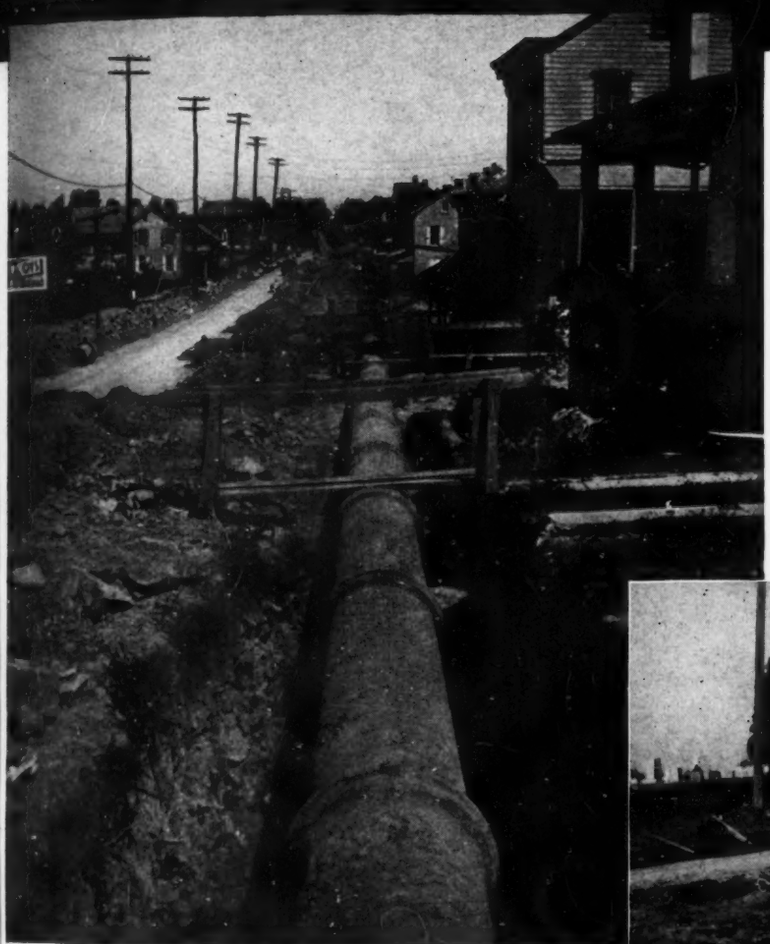
(*Below*) 18,000 feet of 30- to 40-year old, 36-inch cast iron pipe, salvaged and relocated. An additional 18,000 feet of 24-inch and 30-inch cast iron pipe was relocated. Upon completion the entire relocated line was tested in sections at hydrostatic pressure of 150 pounds. Hazen-Williams coefficient averaged better than 150.



(*Above*) Reconditioned and relocated 36-inch cast iron pipe showing fittings and valve. After cleaning and coating the interiors with Bituminous coating, Hazen-Williams flow coefficients immediately after relocation, averaged better than 150 for both 36- and 30-inch pipe, in sections longer than 2,000 feet.

(*Above*)
vaged and
(*At right*)
salvaged a

RELOCATES 7 MILES



Mr. Heine's main problem was to relocate 7 miles of mains without interrupting the supply of water flowing into Reading and tapped by consumers along the Pottsville pike. The job was carried out with almost 100% uninterrupted service. Had the old pipe been abandoned, the estimated cost of 7 miles of new pipe would have been $350,000. Salvage value, long life and low maintenance are the three major economies of cast iron pipe.

(*Above*) 10,000 feet of 51-year old, 24-inch cast iron pipe salvaged and relocated.

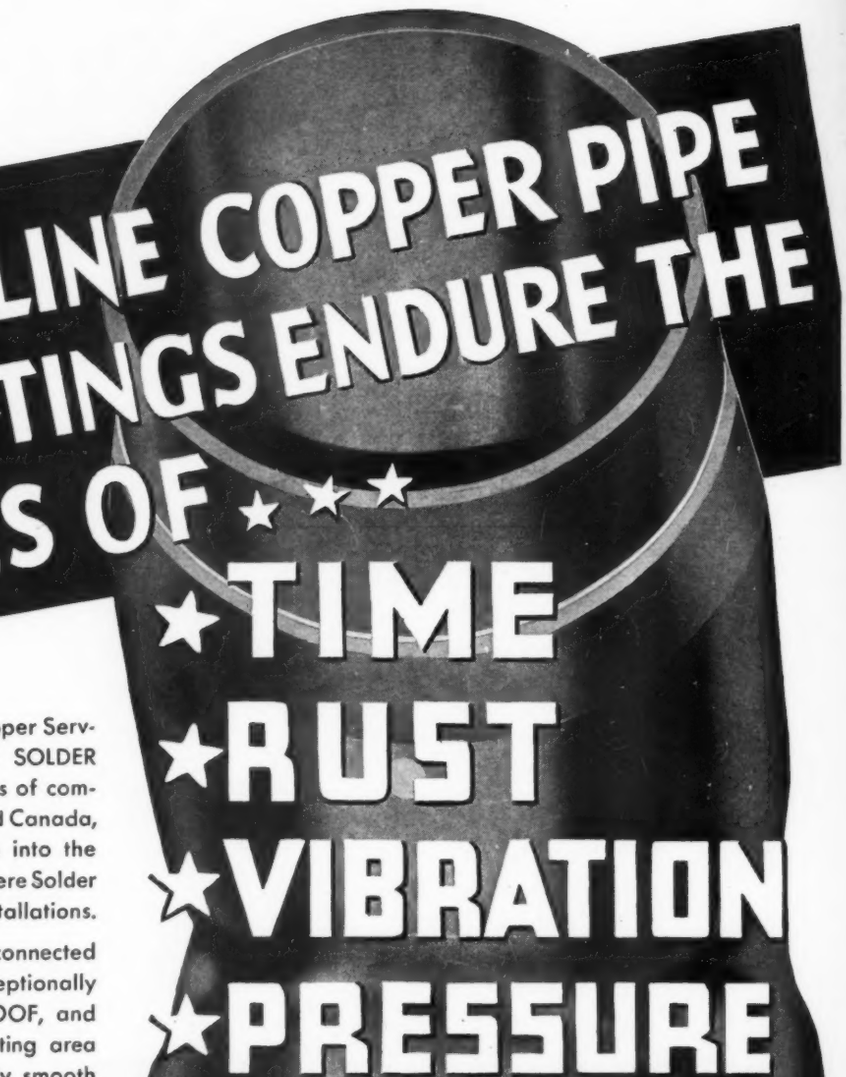
(*At right*) 8,000 feet of 51-year old, 30-inch cast iron pipe, salvaged and relocated.

CAST Q IRON

Look for the "Q-Check" Registered trade mark. Cast iron pipe is made in diameters from 1¼ to 84 inches.

STREAMLINE COPPER PIPE AND FITTINGS ENDURE THE RAVAGES OF

★ TIME
★ RUST
★ VIBRATION
★ PRESSURE
★ FIRE



★ During the past ten years, Copper Service Pipe connected with STREAMLINE SOLDER FITTINGS has been installed in hundreds of communities throughout the United States and Canada, from corporation to curb stop and on into the building. We have never had a report where Solder Fittings failed or leaked in these installations.

A service line of Type K Copper Pipe connected with STREAMLINE Solder Fittings is exceptionally strong; it is LEAK and VIBRATION PROOF, and —IT CANNOT RUST. Since the conducting area through pipe and fittings is continuously smooth and uniform, there are no anchorage points to build up accumulation of foreign matter. Settlement of filled earth for water mains does not effect it.

STREAMLINE Solder Fitting and Copper Pipe are the most efficient materials for water works use, for general plumbing and heating, for many applications in filtration plants, in aeration lines and in heating coils using the sludge digestion system in sewage disposal plants.

STREAMLINE Copper Service Pipe represents one of the lowest cost forms of insurance that water works officials, who are responsible for the return on a heavy capital investment, can adopt

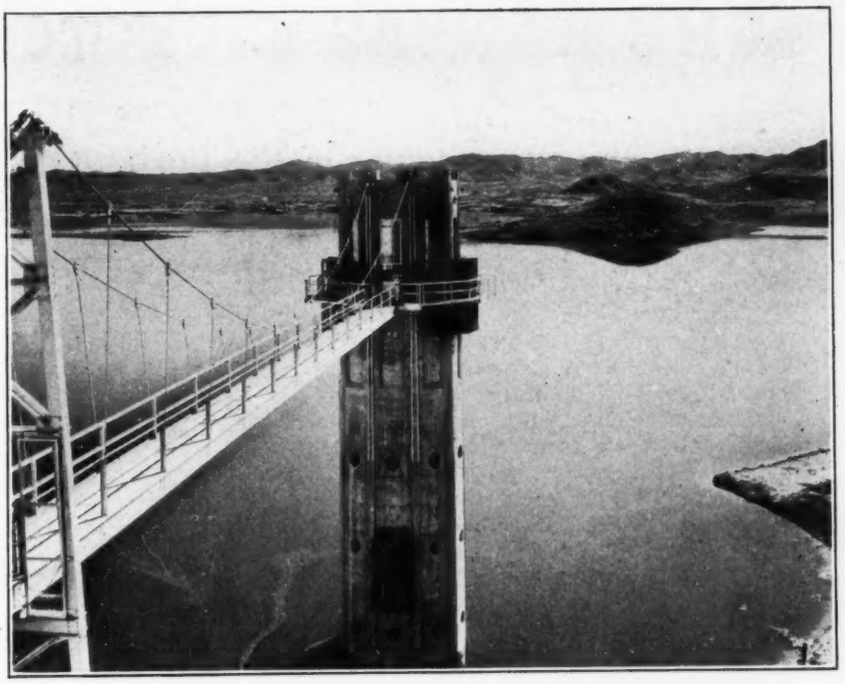
The word "STREAMLINE" is the Registered Trade Mark of the Mueller Brass Co., Port Huron, Michigan. Genuine STREAMLINE Copper Pipe is made only by this Company and is plainly marked for easy identification.

STREAMLINE
PIPE AND FITTINGS DIVISION
MUELLER BRASS CO.
PORT HURON, MICHIGAN

Although the plant will be operated initially using purchased lime, future plans include reclamation and calcination of the calcium carbonate sludge as soon as the quantity of lime used reaches the point where the process becomes economical. With the plant operating above half capacity, a considerable saving can be effected by lime reclamation both in the cost of lime and in the quantity of sludge to be disposed of. If the plant were designed for lime-soda ash treatment, some modification of the process such as the Estabrook or Hoover process would be required in order to prevent magnesium build-up in the sludge. The use of either of these processes adds considerably to the cost of a plant. The lime-zeolite process, without modification, produces the necessary magnesium-free calcium carbonate sludge for lime reclamation.

(This process is to be dealt with in more detail in one article of this series.)

Some sludge must be disposed of using either the lime-soda ash or the lime-zeolite process even though lime reclamation is used. The quantity of sludge produced, however, is much less by the lime-zeolite process than by the lime-soda ash process. Since there are no large flowing streams near the plant site, for the present sludge must be disposed of by lagooning and it is therefore most desirable to keep the quantity produced as low as possible.



Cajalco Reservoir at the Terminal of the Main Line Aqueduct
(See Plan and Profile for location with respect to the Softening Plant.)

Brine Disposal Problem

The lime-zeolite process has one big disadvantage in that the waste brine from the zeolite regeneration must be disposed of where it will not contaminate the underground water supply. This makes necessary the construction of a disposal line which will carry the brine from the plant to tidewater where it will not be objectionable. The added expense of this line makes the cost of the initial 100 m.g.d. capacity lime-zeolite plant more than would be the cost of a lime-soda ash plant of the same capacity. The cost of the ultimate 400 m.g.d. capacity lime-zeolite plant will be considerably less, however, than would be the cost of a lime-soda ash plant of the same capacity.

Type of Zeolite Chosen

Synthetic gel type zeolite will be used because (1) it has high exchange capacity resulting in smaller softener units, (2) the quantity of waste water is small, (3) the salt economy is good, and (4) its life is long, providing the water passed through it is of the right quality. Experience has shown that water having a high temperature, too high or too low pH, too low silica content, and too low total hardness in the water to be softened, all tend to shorten the life of synthetic gel type zeolite. In this plant the water as it comes from the sand filters will be of satisfactory quality for synthetic zeolite in all respects except pH which will be adjusted before it enters the zeolite softeners.

In the next article will be described some of the more interesting features of design incorporated in the plant under construction. The third article, completing the series, deals with "Lime Reclamation" and its economic significance.

One of the Main Distribution Pipe Lines of the Metropolitan System
Concrete pipe line of 9' 8" diameter crossing the Santa Ana River en route to the Softening Plant.—See Aqueduct Plans.

THE KANSAS CITY CONVENTION

(Second Installment)

Proceedings of the Purification Division

By HARRY A. FABER*
Associate Editor

THE many members and guests who came to A.W.W.A.'s 60th Annual Convention to learn, at first hand, latest developments and progress in water treatment were rewarded by what proved to be one of the most interesting technical programs ever staged by the Purification Division. Corrossion prevention, water quality maintenance, and methods for control of tastes and odors, were the featured topics.

Under the newly elected chairman, Paul Weir of Atlanta, and other officers of the Purification Division listed in the first installment of this report (WATER WORKS & SEWERAGE, May 1940), it is predicted that even greater strides will be made by this Division.

First Session Devoted to Committee Reports

The Chairmen of five committees submitted reports on progress in their respective fields:

"Activated Carbon Research" by MATHEW M. BRAIDECH, Chairman.

A voluminous report by this committee covered detailed study of most promising methods for measuring taste and odor, the accuracy of results obtained by various observers, and a summary of progress to date. The Committee held two meetings during the year and considerable work was done.

Some 400 water samples were studied by thirteen observers and much important data was obtained. Wide variation was found, however, between different observers and by the same observers — indicating that odor values are not absolute. Controversy now exists over the desirability of hot vs. cold odor determinations; the heating procedure may produce thermal decomposition and more rapid loss of odors, the cold test may not indicate odors apparent to the public in its hot water supply. Care must be taken to maintain really clean and odor-free glassware, to prevent extraneous odors, and dilution water *actually* odor-free, must be employed in order to prevent "fuzzy" end points. Fatigue of observers should be eliminated by rests of one-half hour between tests.

Test procedure for threshold odor determinations was outlined according to three methods: Skip Positive, Multiple Dilution, and Short Parallel. As a result to date of some 4,000 tests made by about 30 observers, definite progress has been made toward determination of what constitutes most accurate methods, individual sensitivity range, and better individual accuracy. It was recommended that the work of this committee be continued, and that provision be made to publish individual progress reports.

W. P. Division Chairmen
(Retiring and Incoming)

Chas. H. Spaulding
Sup't. of Filtration,
Springfield, Ill.

Paul Weir
Sup't. of Filtration,
Atlanta, Ga.

Chas. R. Cox
N. Y. State Dep't. of Health, Albany
(Long the Division's Secretary)

Horace A. Brown,
Supt. of Water, Ottumwa, Ia.
(His epic experiences with taste and odor, and "super-collosal" chlorination, proved the thrill of the convention.)

"Chloramination" by F. W. GILCREAS, Chairman.

In the absence of the chairman, a progress report was presented by A. E. Griffin, a member of the committee. New research studies and review of published data have been undertaken by this committee.

Studies by *M. L. Crist,* Chief Engineer, Little Rock (Ark.) Water Department, showed that the capacity of a 30 mile supply line had within one year been reduced in carrying capacity from 25 m.g.d. to 20 m.g.d. by growth of crenothrix and slime bacteria. The "C" value had dropped during the year from 147 to 120, the case appearing very similar to that reported previously from Utica, N. Y. (W. W. & S., May, 1939). Chloramine treatment, started on the Little Rock line in June, 1939, has already returned about 50% of the capacity loss, the dosage being 1.6 ppm. chlorine and one-seventh to one-quarter this amount of ammonia. Dr. Hale noted that a one inch thick slime deposit had formed in a Catskill (N. Y. City) aqueduct but, upon chlorination of the water, this had sloughed off.

Work by *R. W. Fitzgerald,* Chief Chemist, Norfolk, Va., on use of chloramine to control growth of algae and other microorganisms was reported. Standard practice at this plant involved three points of application, to the raw, the settled, and finished water as pumped to the distribution system. In summer 60 to 75% of residual is lost, while in winter (at 32° to 50° F.) only 30 to 40% is lost. Residuals as high as 2.25 ppm. are carried in the clear well effluent. Control of bacteria is reported to be excellent (practically sterile water reaching the filters), but this treatment did not eliminate algae and other odors already present, though no new chlorinous odors were formed.

Investigations carried out independently by A. E. Griffin and C. K. Calvert (Indianapolis) have shown some most significant facts in connection with ammonia and superchlorination. When water containing

* Research chemist, The Chlorine Institute, New York City.

free ammonia, naturally present or applied, is treated with chlorine up to or beyond the point of maximum chlorine demand the free ammonia appears to be destroyed.

Louis J. Alexander, Production Engr., So. Calif. Water Co., Los Angeles.

Cecil K. Calvert, Sup't. of Filtration, Indianapolis Water Company

Wm. U. Gallaher, Chemist and Sup't. Water Dep't., Appleton, Wisc.

During the earlier open meeting of the Chloramination Committee, disinfection of pipe lines had come up for discussion and interesting comment was presented. G. R. Spalding, Hackensack, N. J., is convinced that spore-forming bacteria digest jute packing in pipe joints, thereby producing tarry tastes. Several days soaking of jute in strong lime water then storing with lime dust has given satisfactory results in distribution system maintenance.

J. R. Baylis, Chicago, suggested the use of Portland Cement mixed with jute, to supply continued alkaline action. *L. J. Alexander,* Los Angeles, described the practice of his company in which only straight cement caulking of joints is used with very satisfactory results.

O. E. McGuire, Michigan Dept. of Health, Lansing, reported findings indicating flax pump packing to show more contamination than jute. Live steam had been found effective in sterilization of packing materials.

C. K. Calvert, Indianapolis, commented on elaborate studies of sterilizing methods and mentioned use of ortho-mercuro phenol for treatment of hemp as well as to leave a bactericidal residual.

C. R. Cox, N. Y. State Health Dept., Albany, finally pointed out that, irrespective of the quality of water entering the distribution system, bacteria in tap water is of much concern. It is expected, he said, that Federal requirements will shortly cover certification of water supplies (for interstate carriers) on the basis of tap samples. Reasons are, that samples at filtration plants are not representative of true conditions, because tap water is what actually supplies trains, and cross-connections may cause pollution.

"Co-Ordination of Methods of Water Treatment and Laboratory Control" by GEO. D. NORCOM, Chairman.

The report of this committee was read by C. R. Cox. Very little is known of the gastro-enteritis and dysentery diseases, since reporting of such is not mandatory on the medical profession. Thirty-six states are represented in the study reported, and 279 outbreaks are considered.

Of these outbreaks, 55 were suspected as being waterborne and 44 were considered such after investigation. Most cases occurred in camps, institutions, etc., rather than in public water supplies. Only one state has made an intensive study of these epidemics.

Walter Strockbine, Chief Chemist Bureau of Water, Reading, Pa.

Jack J. Hinman, Prof. of Sanitation, Univ. of Iowa, Iowa City, Ia. (For sleeping in class, report to the Dean's Office.)*

[Note: Tearing out this page by Iowa students is forbidden.—Ed.]*

John A. Logan, Technical Service Engr., Mathieson Alkali Works, Chicago.

There is no evidence that chlorine-resistant bacteria are a causative agent, and no other reason has been found to change the original stand of this committee. Conclusions are that, since no proof to the contrary exists, the practical worth of conventional filtration and chlorination is still demonstrated. Confidence in present procedures is justified providing proper control and factors of safety are provided. Future problems requiring study are: specific causes of gastro-enteritis, statistical studies, and further knowledge of bacteria apparently resistant to chlorine.

"Methods of Determining Fluorides" by PROFESSOR A. P. BLACK, Chairman.

The work of this committee, appointed in 1936, is now complete. Ten laboratories have collaborated in testing sixteen methods for the determination of fluoride content of waters. A standard water, synthetically prepared, and 22 samples of natural water, high in fluoride, from 16 states, was provided each testing laboratory. It was found that the fluoride content of water samples does not change, with storage, over a period of one year.

All test methods investigated gave close similarity of results. For a quick analytical method, it is believed that Scott's modification of the Sanchis Method (employing a combination of four reagents into one), will prove the preferred method. Distillation followed by titration, or Sanchis Method, will probably constitute the referee procedure.

W. R. Willis, Chemist and Bacteriologist, Colorado Springs, Colo., in discussing the committee report, presented results of the examination of over 160 water supplies in his State by spectrographic means as well as other developments in analytical methods. After outlining the several means by which removal of fluorine may be accomplished on a practical scale, Mr. Willis said "The time has come for the chemist to turn the job over to the engineer, and for the doctors and dentists to demand the provision of a fluorine-low water for the little children of the endemic localities."

Methods developed for removal of fluorine include activated alumina, bone filters, tricalcium phosphate, Elvove-magnesium, etc. They are suitable for central plants, not home use. Two other removal methods, studied by the author, were described. Electrolysis of Colorado Springs water in porous cells proved capable of producing a 90% removal of fluorine from water remaining in the cathode compartment. A second method made use of the fact that fluorides, together with other dissolved salts are removed by freezing. Several studies of this method with improvised equipment led Mr. Willis to believe that this practice would be commercially feasable; however, no costs were indicated.

"Standards for Purification Plant Operation" by EDW. S. HOPKINS, Chairman.

The work of this new committee has been largely that of planning to date. In the absence of a formal report, C. H. Spaulding presented informal comment on progress made. A study of possible improvements in operating standards for purification plants is underway. Objectives of this committee are to include the number of plant operators in the U. S., size and physical characteristics of each purification plant, adequacy of chemical storage and purification units, etc.

Taste and Odor Control

PANEL DISCUSSION ON THIS TOPIC DRAWS LARGEST ATTENDANCE OF ANY CONVENTION SESSION

Before the start of this session, the assigned meeting room was crowded beyond its seating capacity. Of necessity, a larger room was made available and this, in turn, soon provided standing room only. Such was the index of the importance accorded the production of palatable water, as never before. This all-time record attendance for a Purification Division session was 338 by monitor count.

Those who came to learn the latest and best methods of attack in this problem were not disappointed. Eight speakers presented a variety of experiences which should provide ample ammunition for use in other municipalities.

Controlling Tastes and Odors with Ammonia, Activated Carbon, Copper Sulphate, and Super-Chlorination.

N. A. Thomas, Chief Chemist, Water Dep't., Milwaukee, Wis.

The paper by Mr. Thomas, describing Milwaukee's experiences and discussing the general problem on the West Shore of Lake Michigan, was read by Jos. P. Schwada, City Engineer, Milwaukee.

Replies to a questionnaire, sent to various filtration plants which have Lake Michigan as a common source of water, revealed that algae tastes are a general problem. In the summer of 1939 the most severe conditions of this nature ever encountered were experienced, with the threshold odor number reaching a maximum of 100. In late June and early July a "cod liver oil" taste, due chiefly to Dinobryon, was experienced at these plants. To produce satisfactory finished water, doses of activated carbon from 22.5 to 390 pounds per m.g. were required. Activated carbon is used at all plants in this group except at Glencoe, Ill., where superchlorination, and dechlorination with bi-sulphite of soda, has provided a satisfactory method of control for about ten years.

Full operation of the Milwaukee plant dates from July 2, 1939. Eight days thereafter the threshold odor of the raw water reached a maximum of 45, due largely to Dinobryon. Conditions became so severe that hourly checks for T. O. value of both raw and filtered water were required, and the demand for carbon was so great during one week as to exceed capacity of the carbon feeding equipment available. So rapid was the onset that adequate control of odor was not established until some objectionable water had reached the distribution system.

(1) John Pritchard, Cons. Engr. of St. Louis and Mrs. Pritchard; (2) From Greenville, Tenn., came J. W. McAmis, Sup't. of Water and Sewerage and first in America to practice ammoniation, which he reported to A.W.W.A. (1927) to be "just as simple as rollin' off a log." With him is daughter, Agnes, and Mrs. Dupree of Kansas City. (3) From Richmond, Va., Neptune's No. 1 golfer "Mike" J. Siebert, and Mrs. Siebert.

Odor changes were found to follow very closely the number of organisms in the raw water. The change in intensity can appear very suddenly at Milwaukee, and satisfactory treatment is possible at all times only if rigid control is maintained. Eventually it was learned that the addition of approximately 1 p.p.m. of carbon was necessary for each threshold unit of odor in the raw water.

Miss Lois Sutherland, Sec'y., Water Department, Paducah, Ky. (Believe it or not, this capable piece of femininity is "No. 1 Man" in the Paducah Water Department.)

Dr. George Ornstein, New York City (Germany loses a good citizen whom America is glad to have back. In 1912 at Niagara Falls the Doctor put solution-feed chlorination on the map.)

H. F. Laughlin, Research Chemist, Industrial Chemical Sales Division, West Virginia Pulp and Paper Co., 230 Park Ave., New York, N. Y.

Mr. Laughlin termed his discussion *"Investigations on Taste and Odor Control,"* stressing the desirability of adopting an unbiased approach in comparing various effective treatment methods. Usual investigative procedure by his Company requires two men for determining threshold odors: one to prepare samples and make necessary dilutions; one to smell the samples without knowledge of the dilution which has been employed.

For a thorough understanding of the factors affecting taste and odor control, it was recommended that samples should be collected to indicate the effect of each new process —or the application of each new chemical in the treatment process. The threshold odor determination should be made on each of these samples. It was noted that certain laboratory studies had shown super-chlorination doses beyond the so-called "break-point," to produce tastes difficult to remove with activated carbon.

Investigations at two water plants were described to illustrate how the most desirable point of carbon application could be determined. At Cedar Rapids, Iowa, maximum carbon effectiveness resulted from addition of the dose in a pipe line which carried raw water from the river and thus provided a 45 min. contact period before reaching the treatment plant. This plant is equipped for primary mixing and sedimentation, then secondary mixing and sedimentation before filtration. These mixing and sedimentation steps have average detention times of one and four hours respectively for both primary and secondary stages. In extreme conditions of taste and odor troubles, additional carbon doses may be applied to both primary and secondary mixing basins. During the past winter tastes were so severe that, in addition to carbon application at the several points, aeration was also found to be of some value.

At the Beaver Falls, Penna., plant —also provided with two stages of chemical mixing and settling — a careful survey of carbon application points was made. This indicated that 50 to 80% of the odor could be removed by coagulation with alum and sedimentation. It was of interest, however, that a change of carbon application from primary to secondary mixing stage resulted in but a 15% saving in carbon required. Direct application of carbon to the filters proved the most economical scheme, but increased the frequency of wash, of filters somewhat. Although prechlorination intensifies the

taste and odor problem in this water, such treatment cannot be eliminated because of excessive bacterial pollution which must be partly reduced before filtration.

Walter Strockbine, Chief Chemist, Bureau of Water, Reading, Penna.

Revealed practical information concerning laboratory study and plant application of the super-chlorination process at Reading, Penna. Impounded surface water, supplying the filtration plant, develops seasonal tastes due to micro organisms and decaying vegetation. Many coagulants have been studied with the result that copperas (ferrous sulphate) and lime are most successfully used.

It being thought advisable to carry little or no residual chlorine up to the filters, laboratory studies indicated that the ferrous iron coagulant (copperas), would effectively remove most if not all of the excess of chlorine reaching the plant in the heavily pre-chlorinated water. [This is similar to the oxidation of copperas by chlorine to produce chlorinated copperas, in which one part of residual chlorine is removed in oxidizing each 7.8 parts of copperas according to the reaction $FeSO_4 + Cl = FeSO_4Cl$, commonly known as a double salt.] It was thereby only necessary to add the chlorine dose sufficiently in advance of coagulation to provide effective contact time before dechlorination took place, at no added expense, by the iron coagulant. Application of chlorine in the raw water main leading from the impounding reservoir to the filtration plant was adopted and supplied about 3 hours contact time before water reached the plant.

Superchlorination doses, ranging from 5 to 8 p.p.m. were used in this manner for some four months—from August to November—in 1939. During this period two especially severe growths of Anabaena occurred in the reservoir and the effectiveness of superchlorination treatment was adequately demonstrated. A water practically free of all taste and odor was produced with no operating difficulties. Bacterial counts mounted during passage through the basins and to correct this situation ammonia was added with the iron and lime, affording a satisfactory method of carrying a small chlorine residual across the sedimentation basin having an 8 hour detention period.

(1) *A. Clinton Decker, San. Engr. Tenn. Coal, Iron & Ry. Co., Birmingham, Ala.;* (2) *Earl Mitchell, Sup't. of Filtr., Paducah, Ky.* (*works under America's prettiest Water Superintendent*); (3) *H. A. Moffatt, Industrial Chemical Sales Co., Detroit;* (4) *H. E. Hudson, Jr., Assistant to John Baylis, Chicago Exp't'l. Filter Plant* (*Sec'y.-Treas. of the Illinois Section*); (5) *A. H. Ullrich, Sup't. of Filtr., Fort Smith, Ark.;* (6) *Carl J. Lauter, Sup't. of Filtr., Washington, D. C.*

The distribution system has much old piping (some mains are 100 years old) and it has proven necessary at Reading, as in some other systems, to control residual chlorine in the system carefully so as not to produce secondary tastes from reaction with decomposing organic deposits in sluggish flow sections—dead ends in particular.

Louis J. Alexander, Supervising Eng'r., Southern California Water Co., Los Angeles, Calif.

The iron and sulfur groups of bacterial organisms found in domestic water supplies, and the odors and tastes produced by them, can be successfully controlled by superchlorination and dechlorination. This, the first statement by Mr. Alexander, appeared well proven as he developed the story of seven years study and accomplishment in this direction. His discussion, enlightening and thorough, deserves careful reading when published in its entirety.

Much of the water supply of Southern California is obtained from essentially underground lakes—water depressions. The geologic formation and peculiar characteristics of these reservoirs accounts for the fact that, since water levels have been lowered and pumping is from near the bottom, the lower strata are most highly contaminated with decaying organic matter. The history of changes in water quality at one of several plants was cited as typical.

Until 1932 water flowed by artesian pressure into the forebay of the Sentney plant, but excessive pumping has now lowered the water table to 180 feet below the surface. By 1931, at a 140 foot level, carbon dioxide, hydrogen sulfide, methane and slimy bacterial growth began to appear in the water. In 1936 coagulation and filtration were installed. The first chlorinator was installed in 1931, and the chlorine dose was gradually increased to 1 p.p.m., but this was found to produce a medicinal taste, and a larger chlorine dose was required. Ammonia proved unsuccessful for controlling the tastes which developed. In addition, the use of ammonia stimulated slime growth in the plant and distribution system.

Finally, superchlorination, followed by coagulation, sedimentation, filtration, and dechlorination through granular activated carbon pressure filters has proven completely successful. These carbon filters have operated without difficulty for over four years at a 1.5 to 2.0 gal. per min. per cu. ft. At several other plants sulfur dioxide, for dechlorinating, has been in use for as long as six years with complete success.

The seven plants operated by the company under the latter method of treatment are entirely automatic. Chlorinators, well pumps, and dechlorinating equipment—with automatic control valves—are built up from standard equipment and parts. Other methods of treatment in the area of ground water troubles in California have proven unsuccessful.

L. B. Harrison, Sup't. Filtration, Bay City, Michigan, asked why aera-

Wide Open Red Gulch—The Scene of the Wednesday Night Jamboree

(*The First National dealt out paste-board money to gamblers but Kelly's Saloon was the real thing.*)

(1) *W. B. Day, Plant Sup't. and Ed. Hinkle, Supt'. of Distribution & Sewerage, Garnett, Kansas;* (2) *H. S. Peterson, Hayes Mfg. Co. and Albert Davis, Sup't. Water and Sewerage, Austin, Tex.;* (3) *Here is a "coast to coast hook-up"—Fred B. Nelson, Engr. Dept. of Water Supply, New York City, and Fred S. Porter, Manager Water Dep't., Long Beach, Calif.;* (4) *A Couple of Iowa "Supers"—A. K. Olson (Creston, Ia.) and H. Y. Pedersen (Marshalltown, Ia.);* (5) *M. V. Moss, Mgr. Water Dep't., Amarillo, Texas, and Walter Bowman, Research Engr., Mueller Co., Decatur, Ill.;* (6) *Earl A. Smith, Badger Meter Co., Milwaukee, and R. J. LaMarre, Sup't. of Filtr., Detroit (Chm'n. of Michigan Section).*

tion was not employed to reduce the content of dissolved gases in these waters. In reply, Mr. Alexander said that six of the seven plants did provide aeration, generally by means of compressed air applied through diffusers and in ample volume. *F. E. Stuart,* President, Activated Alum Corp., Baltimore, suggested the development of a heavy activated carbon, weighing about 50 lb. per cu. ft., which might be used in filter beds as an upper dechlorinating layer over the sand weighing 100 lb. per cu. ft. *W. A. Helbig,* Eng'r., Darco Corp., New York, explained that such carbon would necessarily show a rapid loss of absorptive capacity and would necessitate frequent reprocessing to react with it.

Wm. U. Gallaher, Chemist and Sup't., Appleton Water Plant, Appleton, Wis.

Lake Winnebago in Wisconsin provides the water supply of several cities along its shores. This lake is large (30 by 10 miles), shallow (average depth 15.5 feet), provides several months detention, and is variable in quality due to wind effects. It is readily apparent that such conditions are very conducive to algae growths and the summer of 1939 was outstanding in this respect, up to 9,000 standard units per cc. of Anabaena being recorded. This heavy growth, blown into the Fox River, caused the death of many game fish through depletion of the oxygen supply. During the summer an average B. Coli index of about 10,000 was typical and up to a 100,000 index was reached on some days. Drastic treatment was required for such heavily polluted raw water.

First, aeration is provided by means of spray nozzles—giving a 40 to 50% removal of odor when highest odors are encountered and lower efficiency when odors are less extreme. At maximum efficiency, aeration results in a $10.20 per m.g. saving in reducing the carbon required. Large doses of alum are required for coagulation and, unless high doses of prechlorination are employed, pronounced algae growths take place in the settling basins. Bacterial results show use of a 1 to 6 ratio of chlorine to ammonia results in practically sterile surface water in basins, but the bottom sludge contains up to 300,000 colonies per cc.

Limited laboratory studies of superchlorination indicated an 8 ppm. chlorine dose effected about 50% threshold odor reduction after 4 hours of contact. With activated carbon much of the odor removal takes place on the top of filters, and very large doses of carbon are required when conditions are at their worst. There is considerable discharge of bacteria in filter effluents, despite the fact that practically sterile water is applied to the filters. Post chlorination is used for final disinfection, with a 0.6 to 0.7 residual leaving the plant.

In one filter unit, consisting of all new sand, it was possible to try excess lime treatment. A 99% removal of algae resulted, and chlorine demand of the effluent was greatly reduced. Activated carbon, in plant operation enables production of a finished water having 3 to 5 threshold odor, but some additional taste develops within the distribution system.

Cecil K. Calvert, Sup't. of Purification, Indianapolis Water Co., Indianapolis, Ind.

Mr. Calvert reported on observations in plant operation and what might be properly classified as pure research in combatting the taste and odor problem. Experience with use of the cupri-chloramine process, as developed by Houston and Harold in London, was first described. The 0.3 p.p.m. dose (for algae control) as recommended was found not to be effective, since algae growth is very rapid in the Indianapolis basins where water is very clear due to coagulation.

Ten times this dose—or 3 p.p.m. each of copper sulfate, chlorine, and ammonia—were required at Indianapolis for effective control. It is apparent that such doses are undesirable, economically and otherwise. All three chemicals are effective under certain conditions, since copper affects some algae and chlorine (maintained in persistent form by ammonia) affects other types.

In superchlorination studies, work at Indianapolis early indicated that all of the applied chlorine could not be recovered in tests applied to the water which contained ammonia. It had been learned that the content of free ammonia indicates the chlorine demand for complete satisfaction, the ratio being 7.5 chlorine to each 1.0 nitrogen in the form of free ammonia. When the maximum demand is satisfied and the "break point" is reached no free ammonia exists in the water, and more complex nitrogenous compounds (such as amino acetic acid) are shown to be likewise oxidized by adequate chlorine doses with proper contact time. [These discoveries appear to us to be of basic importance in the mechanism of super-chlorination effects and bear considerable emphasis.—Ed.]

The superchlorination process has been in use at the Indianapolis plant for several months, and water quality is found to be materially improved when chlorinated beyond the point of maximum chlorine demand in the presence of excess chlorine and long contact. A control method which has proved satisfactory involves starch iodide titration of residual chlorine, with and without added acid added, to determine adequacy of dosage. The two titrations must check. To complete odor removal activated carbon is employed. The sludge in settling basins is now much less odorous than with previous treatment and there are other advantages.

When available in full, these studies will be found to explain many hitherto unrecognized factors in water chlorination. Limited data presented by means of slides indicated the bacterial results, for dependable disinfection, also to be correlated with complete satisfaction of the chlorine demand. All who are concerned with water purification will find this paper to be of great practical value and the answer to some perplexing questions in the choice

(1) Guy H. White, Supt. of Water, Columbia, S. C. (New Director), and J. F. Pearson, Supt. of Water, Orangeburg, S. C.; (2) E. H. Lewis, Pres. Tate Pipe Linings Co., Andover, Mass., and Jas. E. Gibson, Genl. Mgr. Water Dep't., Charleston, S. C.; (3) Paul Fox, Chief Engr., State Dep't of Health, and O. B. Summers, Mgr. New Mexico Power Co., Sante Fe, N. M.

and control of super-chlorination dosages for economical attainments.

Horace A. Brown, Sup't., Ottumwa Water Works, Ottumwa, Iowa.

The data presented by Mr. Brown was taken from his paper printed in the April, 1940, issue of WATER WORKS & SEWERAGE under the title "Super-Super-Chlorination." It is suggested that any reader who has not yet reviewed this paper should do so—to learn in detail under what extremely severe taste, odor and pollution conditions such treatment has been proven effective. Mr. Brown's story was acclaimed the thrill of the convention program.

Water Works history has been made at the Ottumwa plant. Never before, and perhaps never again will such heroic dosages of chlorine be employed for destruction of tastes and odors. When the raw river water supply is composed of 33% sewage, contains little or no dissolved oxygen, and brings truckloads of dead fish into the intake daily, more severe treatment problems are difficult to picture. Threshold odors of over 600 proved beyond the range of normal and abnormal doses of coagulants, prechlorination, lime and activated carbon.

As the only alternative treatment possibility, superchlorination tests were run in the laboratory. These indicated that a chlorine dose of about 112 p.p.m. (over 900 pounds per m.g.) would bring the threshold odor down to below 4. After many feeding difficulties, quickly surmounted, plant operation amply proved the accuracy of laboratory indications. [But read the whole story as an example of a will to do and ultimate accomplishment. We must admit that it took real intestinal fortitude and this Mr. Brown had in the emergency.—Ed.]

A. E. Griffin, Sanitary Eng'r., Wallace & Tiernan Co., Inc., Newark, N. J.

Studies by the author, on both plant and laboratory scale, at widely scatered water treatment plants, have given much information on "breakpoint" (superchlorination) treatment. In the majority of instances, the dose of chlorine required for this purpose is not excessive—usually being about 5 p.p.m. and ranging up to 35 p.p.m. occasionally. Often chlorine alone, with proper control, is found to be effective for taste and odor control. For other waters, both chlorine and carbon are required, while in a certain few waters dechlorination must be used.

Mr. Griffin mentioned the successful treatment, by high chlorine doses,

John E. O'Leary, Gen'l. Mgr., Pitts'bg. Des Moines Steel Co., Pittsburgh
Major B. J. Coy, City Engineer, Ft. Collins, Colo.
Lloyd M. Rebsamen, Engr.-Mgr., Water and Light Dep't., Jonesboro, Ark.

of waters having tastes due to algae, phenols, and organic decomposition. He commented upon and illustrated by means of slides the types of "breakpoints" exhibited by characteristic as well as abnormal waters studied in many sections of the country. Color removal is generally found to be 75% or more, and coagulation is aided by such treatment with chlorine. No material change in pH takes place except in waters of very low solids content—i.e. weakly buffered waters.

When appreciable quantities of free ammonia are present in the water the "breakpoint" will be found at a correspondingly higher dose of chlorine and the "break" is quite pronounced. Waters which are low or lacking in free ammonia content show *no* recognized "breakpoint." Further, the "breakpoint" always occurs where no more chlorine can be assimilated by the water. In other words its demand has been essentially 100% satisfied in the presence of the excess chlorine.

Three methods of plant control of this treatment process were described: That used by Mr. Howard at Toronto, based on the free ammonia content of the raw water; that used by Mr. Laux, at Anderson, Ind., which depends upon the speed of color produced by ortho-tolodin; and the procedure employed by Mr. Calvert, at Indianapolis, in which neutral and acid starch-iodide titrations with thiosulfate are made.

From results obtained at these diverse treatment plants with many types of waters and based on the control methods already established, Mr. Griffin concluded that it is quite evident that "breakpoint" chlorination has justifiably established a place in water purification processes.

J. R. Baylis, Physical Chemist, Dep't. Public Woorks, Chicago, Ill.

Mr. Baylis, scheduled to present a summarization of the discussions, said it was not possible to readily summarize the varied papers presented, but he did offer several comments and critical predictions. Considering that only a few years ago it was not admitted that extreme taste and odor conditions could be controlled, present day progress has been the more pleasing. About 20 years ago he had made a plea in a paper given in 1923 that we should produce more palatable drinking water and his thought, at that time, as now, was that "a dead end should be connected to the home of every plant operator."

It had now been shown that means are available to combat essentially every taste and odor condition. Doses of chlorine and/or carbon, required to produce a palatable water, may be higher than was recognized some years ago, but they can be used when warranted. Only by treatment in proportion to the pollution can a palatable and bacteriologically safe water be produced, and this must be paid for whether it is pleasing or not.

At this trend toward the requirement of higher standards of purification continues everyone, he predicted, will be satisfied. The manufacturers of chlorine, chlorinating equipment, and of activated carbon, will sell more of their products; health authorities will be gratified at the higher degree of disinfection; the consuming public will be pleased with a purer and more palatable water. The cost of improved treatment will be higher, too, but the public will not be found averse to paying the bill as long as the product is satisfactory. [We might add that if the product is unsatisfactory, the con-

(1) K. C.'s Harpers, who are the Omega Machine Co. On the left is L. E. and on the right is E. E., who pioneered the Omega Dry Feeder; (2) G. Webber Knight, Mgr. Natrona (Penna.) Water Co., a Penna. Salt Co. property, and Jas. H. Kennon, Mgr.-Engr., Bureau of Water, Pittsburgh, Pa.; (3) Alan Drake, former Manager of Buffalo Water Works and now Sales Engr. for Alco Steel Pipe, with Loran D. Gayton, City Engr. of Chicago; (4) "Water Works and Sewerage's" Larry Lingnor of Chicago and H. E. Hudson, Jr., Chicago Exp't'l. Filter Plant; (5) Filtration Superintendents, A. V. Graff (St. Louis) and W. S. Mahlie (Fort Worth).

sumer will more and more object to paying any part of the bill.—Ed.]

In subsequent discussion of these papers, it was apparent that the Ottumwa experience had rested uppermost in the interest of the audience.

E. Sherman Chase, Boston, Mass., asked Mr. Brown the length of time elapsing before consumers found the water palatable. It was explained that, with the failure of early purification methods, people had largely ceased using the municipal supply for potable purposes; following satisfactory treatment by superchlorination, however, the system was thoroughly flushed to remove water high in taste and odor—then the water was gradually found to be satisfactory.

A. F. Mellon, Minneapolis, Minn., wished to know the effect of chlorine injected as gas in such tremendous doses into the suction side of the centrifugal pump. Mr. Brown replied that an examination of the pump had been made when the extreme chlorine dose was discontinued. Somewhat surprising to them, there was no apparent ill effects, perhaps due to hard water which had coated pump and impeller with protective scale.

L. I. Birdsall, Chicago, Ill., noted that the Des Moines sewage now receives treatment and cannot again affect the Ottumwa water supply so adversely.

J. J. Hinman, Univ. of Iowa, expressed curiosity as to the curve of goldfish deaths during the Ottumwa experience. Mr. Brown reported no complaints had been received on that score.

Norman J. Howard, Toronto, Canada, spoke of the tremendous variation in purification problems and of the different approaches available to solve them. When studying superchlorination for control of chlorophenol tastes some 15 to 20 years ago, he had found his research to be commended but had received criticism that pollution should be prevented rather than cured. It is true that pollution from industrial wastes can be largely prevented; however, tastes and odors due to algae and vegetation are our major problem today—and these must be controlled almost entirely in the water treatment process. Among the pioneers in taste and odor control development, it was pointed out that the names of Baylis, Spaulding, Enslow, Hale, and McAmis were outstanding. [As far as we are concerned the present rebirth of superchlorination is the most effective possible proof that Norman Howard was No. 1 Pioneer on this Continent.—Ed.]

Chas. R. Cox, Albany, N. Y., described experiences in New York State water plants, mentioning that chlorine doses of 5 p.p.m. and less proved effective in the softer waters. Even with high residual chlorine (in one instance an 0.8 p.p.m. residual was increased to 2.0 p.p.m.) the treated water is tasteless. It is recommended, however, that dechlorination be practiced because subsequent tastes may be produced by such high residuals reaching deposits in the distribution system.

Two Experiences With Corrosion Control

"Corrosion Prevention by the Use of Sodium Hexametaphosphate" by Edw. C. Trax, Chemist, Filtration Plant, McKeesport, Pa.

Discussing experiences with the use of Calgon in a water which contains mine drainage, the author noted that red water was effectively prevented at a pH of 6.0. At that pH, 2 p.p.m. of Calgon stopped complaints of red water and corrosion in a brewery supply. The consumption of water at this city has decreased from 9 to 2 m.g.d., largely because of the reduced amount required for quenching coke at coke ovens. The distribution system is 18 miles in length and consequently flow of water is very sluggish.

Acidity of the water is caused by mine drainage, which also causes an iron content as high as 5 p.p.m. Following the completion of a filtration plant, it was found that tap water showed an iron content of 5 to 18 p.p.m. iron and a maximum of 29.5 p.p.m. in some samples. Apparently the iron formerly deposited by untreated water in the system is being picked up by the filtered water. Lime, 10 p.p.m., and Calgon in decreasing dosage (4 p.p.m. the first week, 2 p.p.m. the second week, and 1 p.p.m. since) has been partially successful in overcoming the trouble. Occasional troubles, believed due to sloughing off are still experienced.

Robert Spurr Weston, Consulting Engineer, Boston, Mass., presented the second discussion on corrosion control with Calgon. In the author's absence the paper was read in abstract form by Secretary Cox. Water supplied from driven wells by the Fairhaven Water Company, Mass., is corrosive and has caused accumulation of ferric hydrate in mains. The water averages 30 p.p.m. carbon dioxide and has a pH of 5.6. Dezincification of galvanized service pipes in homes is especially important, though the iron content of tap water is never over 0.15 p.p.m.

Since June, 1939, water has been treated with either 45 p.p.m. lime, which produces a pH of 8.3, or with 47 p.p.m. soda ash, giving a pH of 8.4. Corrosion was only slightly reduced by such treatment, and the addition of Calgon was recommended following experimental tests of its value. A dose of 2 p.p.m. Calgon, applied at the plant, at first resulted in 16 p.p.m. iron content at dead ends of the system. With continued application, analyses now show this water to contain iron as follows: 0.11 p.p.m. at the plant, 0.07 p.p.m. at the center of the distributing system, and 0.10 p.p.m. at dead ends. At these same points alkalinity is 9, 10, and 11 p.p.m. while free carbon dioxide is 52, 41, and 51 p.p.m. Formation of an inhibiting film on the metal was given as a possible explanation.

C. P. Hoover, Columbus, Ohio, described experiments which have been under way for nearly one year with Columbus water. Six hot water boilers are operating at controlled 140 to 150° F. temperatures and as little as one-quarter p.p.m. Calgon has been found to prevent deposi-

Ambassadors of Commerce

(1) Dapper "Pete" Peterson, Hayes Mfg. Co., Erie, Pa.; (2) "Mike" Foley, Hersey Meter Co., Chicago; (3) "Bob" Turner, Rensselaer Valve Co., New York (4) A. E. Hargett, Ford Meter Box Co., Bowling Green, Ky.; (5) H. C. Erwin, Southern Mgr., Hersey Meter Co., Atlanta; (6) Frank Brooks, Gen'l. Mgr., Art Concrete Works, Pasadena, Calif.; (7) "Ted" Williamson, Twin Valley Iron & Steel Works, Fort Worth, Texas.

tion of calcium carbonate at such temperatures. The tanks will be opened after one year and examined for internal effect of this water.

Owen Rice of the Calgon Company stated that Calgon is now in use at some 30 municipal plants, under conditions of both high and low pH. At only two plants has there been any removal of preformed scale —in both of these iron oxide had been precipitated prior to use of Calgon—and rate of water flow appears to remove scale in proportion. Laboratory experiments indicate that no protective film formation is noted when Calgon is employed at pH lower than 5.0—i.e. corrosion is not inhibited at such a low ph value.

Calgon and Physiology

"The Physiological Effects of Sodium Hexametaphosphate" by K. K. JONES, Ass't. Prof. Physiology and Pharmacology, Northwestern Univ. Medical School, Chicago, Ill.

The effect of various mineral salts and their utilization in living organisms was described in detail by the author. It will be necessary to read his paper in full to obtain a clear picture of this complex subject with reference to phosphate reactions, it was noted that phosphates combine with sugars producing substances assimilable by living cells. Metaphosphate is not of itself toxic but depends on presence or absence of calcium.

There are two effects of metaphosphate on skin: one is on the calcium content but is inconsequential; and another on proteins, to form a film or protective effect. Phosphate, as metaphosphate, controls the calcium metabalism and food supply of cells. Reversion of meta-phosphate to orthophosphate is much hastened by acidity of the stomach. Metaphosphate is rejected by the stomach if taken in large doses and is not in any degree cumulative in its effects. Dr. Jones, in concluding, reported that animal experiments had indicated that there is no toxicological problem with this material fed in reasonable dosages. Furthermore, it could not be tolerated by the stomach in quantities which would be detrimental to metabolism.

Considerations of Water Quality

"Depreciation of Water Quality in Distribution Systems: Bacterial Quality," by NORMAN J. HOWARD, Director of Water Purification, Toronto, Ont., Canada. (President of the Association).

Mr. Howard first carefully limited the intent of his discussion: "When water of good sanitary quality enters a distribution system, and is not subject to secondary pollution, the sanitary significance of bacterial depreciation is negligible." Under such conditions, he said, we must consider the source of supply, the extent of purification, and seasonal depreciation. Greater bacterial deterioration in the system is always found during summer months.

It is important to note that cultured strains of bacteria have higher resistance to chlorination than have the same organisms when found in water. While the study by Levine shows a 0.2 to 0.4 p.p.m. chlorine residual to be unreliable as index of coli-aerogenes destruction, there is no single record of incidence of disease associated with such resistant strains as used in the study. It is conceivable, however, that some constituent in the water may interfere with the action of chlorine. Even with the seasonal variation in bacterial flora there appears to be no comparable variation in incidence of disease. Filters appear to be selective in respect bacteria removal—often the coliform test showing less removal than counts on solid media.

Three factors of major importance are indicated: The routine treatment of raw water may not have destroyed the bacteria, and they return to vigor. Their growth may be stimulated by decomposition of slime on the interior of water mains. In absence of sufficient chlorine residuals, decomposition of pipe slime during summer months provides food supply.

The remedy proposed for prevention of bacterial depreciation was seemingly a more perfect pretreatment of the water. It was noted that superchlorination should destroy all bacteria; but, water so treated may be more susceptible to rapid multiplication of bacteria when again contaminated. In Mr. Howard's opinion, if water is once adequately sterilized, future deterioration is of no sanitary significance.

J. R. Baylis, in discussing this paper, noted that early studies in Baltimore and others since in Chicago showed water samples from dead end mains to be frequently highly charged with coliform organisms. Water high in manganese appears to provide excellent conditions for regrowth and granular carbon filters may be difficult to keep sterile. He warned against the danger of depreciating the significance of contamination in distribution systems.

C. R. Cox, requested that further data be submitted to the Co-ordinating Committee under Mr. Norcom. Comparable data concerning bacterial quality of water leaving the plant and in the distribution system is needed for study and evaluation.

"Chemical and Biological Quality," by A. M. BUSWELL, Chief, and MAX SUTER, Engineer, State Water Survey, Urbana, Ill.

This paper, presented by the senior author, offered a detailed consideration of one water supply—that of the

(1) From the St. Louis Water Dep't.—M. Serkes, Office Engr.; John B. Dean, Commissioner of Water; Wm. Foley, Engr. in Charge of Pipe Laying. (2) A couple of Winners in our booth—the 1940 *Reference and Data Number of* WATER WORKS & SEWERAGE, *boasting new records, and comely Jeanne LaMar. (3) Proving that there's little in a name, this is our Jimmy Angell, and with him a K.C. "wheelhorse," Leadite's Otto Reynolds.*

University of Illinois. Purification problems are difficult because the water is iron bearing and has its source in a glacial drift. A method was early developed to remove the 1 to 2 p.p.m. iron content, but the other difficulties are not solved so readily.

The water contains organisms which precipitate iron and grow plentifully in the distribution system, sometimes breaking away from the pipe walls and discharging in quantity. Various food materials are available in water for bacterial growth: iron, manganese, methane, hydrogen sulfide, ammonia. Apparently the ammonia (present in this water to the extent of 3 to 4 p.p.m.) would produce sufficient bacterial growth to account for one-half to one ton of wet sludge per million gallons, and this is actually indicated in the system.

It is found that a gradual drop in dissolved oxygen takes place with increased flow, that ammonia is oxidized to nitrites and nitrates, and that the accumulations of sludge parallels the decrease of ammonia. Organisms responsible for these changes require 30 to 40 p.p.m. of chlorine for disinfection to be assured. The nitrosomonas and nitromonas types have been definitely identified, and even some azobacter—capable of fixing nitrogen dissolved in water—is found in the system.

Attempts to remove the ammonia by hydrogen exchange zeolite have been found practical but extremely expensive. Further experiments are under way to determine if lime softening methods will destroy the responsible organisms.

[Papers dealing with water treatment which were presented in the General Sessions will be covered in the next installment of this report. —Ed.]

PROCEEDINGS OF THE FINANCE AND ACCOUNTING DIVISION

Reported by—DALE L. MAFFITT*

Each session of the Finance & Accounting Division was attended by more than a hundred members and guests interested in financing and accounting of water works properties. The following constitutes a brief recounting of papers read and discussions presented.

"A Review of Lien Laws in the United States" by H. L. MEITES, Sup't. of Water, Chicago.

First discussed was the need of a lien law to safeguard interests and revenue of municipally owned water works. This paper gave considerable information regarding the status of the lien law in various parts of the country and suggested that the American Water Works Association might secure cooperation of superintendents of various water departments, municipal associations and civic-minded organizations looking toward the practical operation of the lien law.

The paper brought out the fact that the Supreme Court of the United States has ruled in the affirmative on the legality of such a law. And, Mr. Meites pointed out that it is now time for the water works man to present the facts, systematically organize various agencies, and bring about a successful, workable system.

It is regrettable that Mr. Meites was not able to present his paper personally, as he has spent a considerable amount of time on this important subject.

"A Customer's Service Bureau" by HAL SMITH, Sr. Administrative Ass't., Dep't. of Water Supply, Detroit.

Read by L. G. Lenhardt, Gen'l. Mgr., Detroit Dep't. of Water, Mr. Smith's paper pointed out many things that have been worked out in Detroit and should be beneficial to the water works profession,—especially methods of handling water works affairs that bring about efficiency at the water works office as well as the building up of a good and friendly relation between the water works and the general public.

F. A. & Division Chairmen
(Retiring and Incoming)
Dale F. Maffitt,
Gen'l. Mgr., Des Moines Water Works.
John C. Flannagan,
Registrar, St. Paul Water Dep't.

It was pointed out that department rules and policies must be adhered to in order to give effective service, and that conferences of employees and department heads are important in training public employees in how best to serve the public.

Mr. Smith's paper recited that from the beginning they were confident that the employees of the department would cooperate with the management in development and carrying out this important program, and that the system will tend to encourage further development of the in-service training idea for public employees, and should tend to correct the erroneous but wide-spread impression among certain groups of private citizens that public employees are a peculiar breed of individuals who are interested in nothing but their paychecks.

"The Texas Fire Insurance Department of the Board of Insurance Commissioners" by ALBERT R. DAVIS, Sup't. of Water, Austin, Texas.

Mr. Davis discussed the workings of the insurance department in Texas and brought out important matters of legislation regarding the effect of the insurance laws in his state.

"Special Rates and Free Water Service" by DALE L. MAFFITT, Manager, Water Department, Des Moines, Ia.

This paper was discussed at length by a dozen or fifteen men. The general feeling expressed by those offering suggestions was that the Water Department should not be called upon to furnish free water. It was pointed out that the water plant should be conducted as any other successful business and that the service rendered by the Water Department should be paid for by

* As the presiding officer Chairman Maffitt has very kindly supplied this digest of the F. & A. Division Proceedings.—Ed.

all receiving the benefits of this service.

"Experiences With a Department Newspaper" by GEORGE S. BONN, Water Dep't., Springfield, Ill.

Mr. Bonn reviewed experiences of the Springfield Water, Light and Power Dep't. with a department newspaper bearing the caption—"Waterlite News." He emphasized the fact that his organization had felt a real internal benefit from this "newspaper" project, which had built a feeling of comradship between employees and an attitude of friendliness between the management and the workers. He had observed, that next to the employees' paycheck, the news publication maintains its interest to workers and bosses alike. It seems to be read from cover to cover and then taken home for the rest of the family to read.

Mr. Bonn said that he believed they were developing a community spirit through the "Waterlite News" which can be attained in no other way. Sample copies were distributed and we understand that such will be mailed to readers of this magazine who may be interested in seeing the type of job that "Waterlite News" is doing.

Combined Utility Management and Operation

"The Management of Combined Municipal Utilities" by O. E. ECKERT, General Manager, Water and Light, Lansing, Mich.

Mr. Eckert's excellent paper dealt with the many technical and economic advantages of placing municipal utilities of an allied or interlocking nature under a single proficient management, divorced from political control or dictation.

F. W. Martin, Sup't. of Utilities, Hinsdale, Ill., in a splendid discussion, spoke on the matter of handling

Speakers

O. E. Eckert, Gen'l. Mgr., Water & Electricity, Lansing, Mich.

Albert R. Davis, Sup't. Water Dep't., Austin, Texas.

utility funds. He suggested that in the purchase of materials, (price and quality of goods and services being equal), that it was but fair that preference be given local dealers.

Mr. Martin reported that there is no favoritism shown in their town in the collecting of either electric or water bills. Furthermore, the operation of the utilities is kept separate from the general village affairs, and the net profit (almost wholly from the electric plant) is turned over to the general village fund for municipal operation. The utilities pay no taxes and such profits may be considered to be interest or dividends on the investment in the property. He said that no attempt is made to earn more than a very slight profit on the water plant, this being to preclude the possibility of showing a loss at any time.

Interest ran high in both Mr. Eckert's paper and Mr. Martin's discussion, the principal comments coming from R. E. McDonnell (Kansas City), A. P. Gumlick (Denver) and J. C. Keith (Windsor, Ont.).

"Efficiency in the Management of Water Works Properties" by LEONARD N. THOMPSON, Sup't-Engr., Water Dep't., St. Paul, Minn.

Mr. Thompson's paper was a very definite contribution to the water works industry. He emphasized the importance of cooperation between water works management, employees, and the general public. He suggested that the complex nature of water treatment and its essentiality for modern industrial and domestic existence, has practically placed it alongside any big business in the field of industry and commerce.

Mr. Thompson closed by saying: "If service is our first consideration, service efficiently given is an obligation. With relief from outside influence, the water works manager should neither ask nor receive exceptions to the rules which govern the efficient management of a private industry."

"Legal Decisions Relating to Water Distribution" by F. A. MARSTON, Metcalf and Eddy Engr., Boston.

Mr. Marston pointed out many of the legal problems that are encountered by the water works man and gave a good interpretation of the problems of the water works operator, as regards legal decisions pertaining to his business.

At the close of the session officers were elected. A full list of officers of all Divisions appeared in the May issue of WATER WORKS AND SEWERAGE. The F. & A. Division officers are:

Chairman: J. C. Flannagan, St. Paul, Minn.

Vice-Chairman: Geo. F. Hughes, Denver, Colo.

Secretary-Treasurer: W. Victor Weir, University City, Mo.

Directors: Dale L. Maffit and M. F. Hoffman.

The retiring Chairman expressed a hope that the fine work being done by the Finance & Accounting Division be carried on, in order that this Division might become a more important part in the affairs of the Association.

A.W.W.A. Issues 59 Year Index

(Covers All Association Publications)

An INDEX to 59 years of the American Water Works Association's publications is now available. The new Index covers the *Proceedings* for 1881 through 1913; the *Journal* for 1914 through 1939; and other Association publications.

In the "Cumulative Index" is found a chronological listing of all published papers — grouped under 70 major subjects of the water works field. Some subjects are further divided for the reader's convenience. Besides a complete Author Index, the book also includes descriptions of other publications issued by the Association, and those issued by A.W.W.A. jointly with other organizations.

The 59 Year Index, a book of 285 pages, is being sold at the following prices:

To members	$1.75
To members (cash with order)	1.50
To non-members (for cash only)	2.00

Address inquiries or order to A.W.W.A. (Book Dep't), 22 East 40th St., New York City.

MARYLAND - DELAWARE WATER AND SEWERAGE ASSOCIATION

IT becomes somewhat monotonous to keep reporting that the "X-teenth" meeting this or that water or sewage works association established new records; was the best ever staged, etc. However, it seems to be the order of the day for these meetings and conventions of water and sewage works folks to constantly improve, and it is a pleasure to note and be able to report as much.

In this "march of progress" the Maryland-Delaware Water Works and Sewerage Association proved no exception and staged, what many of the oldest members considered, its best all-round meeting in the history of this 14-year-old Association. The meeting in question was that held May 16th and 17th in Salisbury—Maryland's No. 1 City on the Eastern Shore.

Possibly it can not be said of the registered attendance that a record was made in comparison with earlier meetings held in Baltimore and Wilmington, but we feel confident that the 126 registered (162 attending the Annual Dinner) is a record for a "Grass Roots" meeting of this Association. It takes more than numbers, however, to make a successful meeting, and whatever may have been lacking in bulk was more than made up in the quality which keynoted the entire meeting.

Excellence of Entertainment and Program

We believe that something special deserves to be said concerning the excellence of the annual dinner and the floor show and the dance that followed. As to the topnotch floor show, it rivaled the best that the National associations have ever produced and was perhaps the most costly ever put on by a sectional Association, for the entertainers were of the best and the variety impressive. To pay the bill for this, and the special entertainment for the ladies, the Association had to dig into its surplus, which the Treasurer's report indicated could be safely done.

The technical program was no less satisfying, holding sessions attendance at its best. The variety of topics, the snappy presentations, and the interest manifest was impressive. Because of space limitations this report can only do partial justice to the quality of material presented, and this we regret. One paper read by a plant operator, who deserves especial recognition for his accomplishments

(1939)—Presidents—(1940)

A. M. Tawney, Sup't. of Filtration, Ft. Meade, Md.

Geo. E. Harrington Chemist, Water Div., Washington, D. C.

in improving plant performance with very limited means at his disposal, but ingenuity aplenty, is to be printed in full in a forthcoming issue.

"Wheel-Horses"
From the Engineering Div. of Maryland's Dept. of Health.

J. R. McComas (Served as Sec'y.-Treas. in absence of A. W. Blohm, seriously ill.)

M. H. Coblentz (Chairman of Committee on Program.)

Short School to be Held Again

It was reported in the Business Session that although no Short School, such as formerly held at the University of Maryland and sponsored by the Association, was held in 1939; but, that such would be resumed in 1940. [In charge of the Short School is Carl A. Hechmer of the Washington Suburban Sanitary District, Hyattsville, Md., and the school will be held in September.]

New Officers

The following were named as officers for the ensuing year:

President — Geo. E. Harrington, Washington.

1st Vice-Pres.—J. M. Jester, Hyattsville.

2nd Vice-Pres. — R. A. Norris, Sykesville.

Sec'y-Treas.—A. W. Blohm, Baltimore.

Technical Sessions

(Pres. A. M. Tawney, Presiding)

The Technical Sessions were opened with a paper by GEORGE L. HALL, Chief Engineer of the Maryland Department of Health, which dealt with **"Potentialities of Well Contamination and the Methods of Safeguarding Such Supplies".** In his review Mr. Hall cited cases of deep well contamination in Maryland and the corrections applied. Since wells suffered from hidden dangers, (usually leaks in casings or suction lines) his conclusion was that more continuous protection was needed. Such he considered to be continuous chlorination, which could be justified as a very reasonable expense in the nature of insurance. He emphasized the fact that the published records of American cities showed far too many water borne outbreaks from assumedly safe well supplies.

H. M. Freeburn, Distr. Engr., Penna. Dept. of Health, in discussion, stressed also the doubtful safety of well supplies and cited case histories proving his point that long use without trouble was no safe index. He warned operators and managers that water-borne epidemics were being considered to show contributory negligence on the operator's part, unless every known safeguard has

been applied, citing a Pennsylvania case now being tried as well as earlier cases. He was of the opinion that sooner or later it will be universal practice to chlorinate, or provide some other equally dependable treatment for all well supplies.

R. C. Clement, Wallace and Tiernan Co., also a scheduled discussor, directed attention to the practice of returning used condenser cooling water to the ground through diffusion wells. He questioned this practice of returning such spent (frequently contaminated) water to the ground without disinfection.

"Results from High Rate Trickling Filters at Baltimore," by C. E. KEEFER, Associate Sewerage Engineer and HERMAN KRATZ, JR., Ass't Chemist, Bureau of Sewers, Baltimore, Md.

This paper, presented by Mr. Kratz, reported on two experimental high-rate trickling filters operated as single stage units at Baltimore. In the study results were obtainable alongside of the orthodox 8½-ft. deep filters in use at Baltimore since 1911. The experimental units were equipped with 8-arm rotary distributors 47.5 ft. in diameter, supplied by the Lakeside Engineering Co. of Chicago.

Rates of application of settled sewage was varied between 6.5 and 30 m.g./acre/day, while the control filter was operated at a 3 m.g./acre/day rate constantly. In reporting the results it was pointed out that the filter effluents had not the benefit of sedimentation but contained the full complement of solids leaving the filters continuously. The rates 6.5 to 30 m.g.d./acre constituted B.O.D. loadings of 785 to 5,150 lbs. of 5-day B.O.D. per acre-foot. At rates of 6.5 and 10 m.g.d./acre these units produced effluents with 5-day B.O.D. values of 12.7 and 26.6 p.p.m. (solids included) and in no case was the B.O.D. as high as that from the 3 m.g.d./acre control filter. Only when the rate was 14 m.g.d./acre or more did the slow filter surpass the high rate units in effluent quality. Even at the 26 m.g.d./acre rate (2,525 lb./B.O.D./acre-foot) there was a B.O.D. reduction of 49%. This result was attained in cold weather with sewage at 56°F. Later, with a 30 m.g.d./acre rate in July (4,579 lbs./B.O.D./acre-foot loading) a removal of 3,278 lbs. resulted; a 71.6% reduction with an effluent of 44 p.p.m. B.O.D. (solids included).

The effect of temperature was pronounced. In July with a 75°F. sewage and 30 m.g.a.d. application the effluent was superior to that from the 6.5 m.g.a.d. rate in January, with sewage at 54°F. That the nature of the principal purification effect was bio-flocculation, was indicated by the curves for nitrate production. For instance, the 4 p.p.m. nitrate nitrogen in the effluent at the 14 m.g.a.d. rate dropped to less than 2 p.p.m. at the 18 m.g.a.d. rate and to zero at higher rates. In winter even less nitrification was noted.

Programmers

J. M. Jester, Sup't. Filtr.
Washington Suburban San. Dist'r.
(New Vice-Pres. of the Ass'n.)
Geo. L. Hall, Chief Engr.,
Md. State Dep't. of Health, Baltimore
Herman Kratz, Jr., Chemist
Sewage Treatment Works, Baltimore, Md.

Concerning the relationship of filter bed depth to purification effected, the following was observed. At the 10 m.g.a.d. rate the 5-day B.O.D. removal was 47.5% in the upper 2 ft. of bed; 67% at the 4-ft. depth and 80% for the entire 8.5 ft. (It is to be remembered that the flocculated solids are included in these computations of B.O.D. reductions. Rather significant is the fact that the first

Programmers

Louis R. Kaplan, Sales Engr.,
Calgon, Inc., Philadelphia
Dr. Anthony J. Fischer, Devel. Engr.
The Dorr Co., New York City
C. G. Weber, Superintendent
Sewage Treatment Works, Annapolis, Md.
(A gadget-minded Texan told of kinks and devices; improved plant performance and operating economy.)

2 ft., representing 25% of the stone volume performed practically 60% of the work of reducing the oxygen demand.—ED.)

In their summary, Messrs. Keefer and Kratz pointed out:

(1) There were no indications of ponding, even at the 30 m.g.a.d. rate; (2) Even at rates as high as 26 m.g.a.d. a 50% reduction of B.O.D. can be expected in winter and 70% or more in summer; (3) At rates up to 10 m.g.a.d. filters 2 to 4 ft. deep will serve in summer to effect marked B.O.D. reductions, whereas the winter efficiency will be much less for such shallow filters; (4) It is apparent that high-rate filtration is comparable to chemical precipitation and magnetite filters, but lacks the nitrates which give stability to low rate filter effluents.

Linn H. Enslow, Editor, WATER WORKS & SEWERAGE, in discussion, stressed the fact that all computations made in the Baltimore studies had been made on effluents containing the flocculent material leaving the filters continuously. It was to be regretted that some analyses had not been made on settled samples and, possibly, on strained samples through a bed of coarse sand or magnetite. The conclusions that 50 to 70% purification could be attained would, thereby, have been modified perhaps. In this regard the 67% B.O.D. removal to the 4-ft. depth could safely be predicted as 75% with settling alone and better than 80% with a final straining of effluent. One could liken the discharge of high-rate filters to activated sludge effluent when the latter process stopped short of the expensive high nitrifying stages—both being bio-flocculation primarily and both effluents being subject to marked improvement by straining out the light flocculated matter which passes through the final tanks.

Of particular interest were the observations that much higher rates (loadings) could be handled effectively in warm weather—or so long as the applied sewage is above 70°F. This has significance for plants subjected to heavy loadings in summer and light loadings in winter. Also in treating heavy industrial waste loadings if the waste be warm, notably packing-house wastes as pointed out in the article by L. R. Howson in the May issue of this magazine.

In commenting on permissible warm weather loadings, Mr. Enslow pointed out that B.O.D. loadings up to 4,500 lbs./acre-ft./day were satisfactorily handled in this period at Baltimore. Dr. Levine at Iowa State College had demonstrated that up to 4,800 lbs. is a satisfactory loading at rates of 16 m.g.a.d. He had also shown the marked superiority of the high-rate filter for strong sewages and wastes. At Fargo, N. D., packing house wastes were being satisfac-

torily handled at a steady loading in excess of 5,000 lbs./acre-ft./day where 1,000 B.O.D. waste is applied at a 6 m.g.a.d. rate. However, the Fargo filter is equipped for backwashing with water and air. Here the settling tank improves the B.O.D. reduction, raising it from the 50% through the coarse stone primary filter (6 ft. deep) to 75% and indicative of what settling at Baltimore might have accomplished.

"The Bio-filtration System in Sewage Treatment" by DR. A. J. FISCHER, Engr., Development Dept., The Dorr Co., New York City.

This paper, which was written by Dr. Fischer for publication in WATER WORKS & SEWERAGE, is scheduled for an early issue. In view of this fact, we will merely high-light some of the statements made by the author. The paper is a splendid summation of what is known concerning the high-rate process, and defines all important basic considerations.

Dr. Fischer pointed out that two-stage Biofiltration can be considered the equal of activated sludge treatment and is far more flexible and capable of withstanding shock from industrial wastes or septic sewage. And, single stage treatment with shallow filters is equivalent to chemical precipitation. Of highest importance is the maintenance of a minimum rate of application of 4 m.g.a.d. and anything from that upwards, the only limiting factor being the total lbs. of B.O.D. loading per acre-ft./day. Of secondary importance was the depth of bed, so long as the requisite volume of stone was available—i.e., the limiting factor is only the loading per acre-ft., with depth a secondary factor. No forced ventilation is required for filters of 4-ft. depth and less.

Dr. Fischer placed considerable emphasis on the value of recirculation, on two scores—(1) maintaining a minimum rate of volume application and preferably continuous application; (2) dilution of the applied sewage. He pointed out that the higher the ratio of recirculated effluent to incoming sewage the better the net results in total removal of B.O.D., the only limiting factor being the top permissible rate through the final settling tanks. The dilution plus the purging effect of higher rates of application seemed to maintain more efficient bed functioning as a decolloider and floc producer. For domestic sewage a ratio of between 1 to 1 and 2.5 to 1 appeared the optimum. With proper dilution by recirculation 5.23 lbs. of B.O.D. removal/cu. yd. of stone bed had been a permissible average in treating beet sugar wastes. And, with distillery wastes loading of better than three times this figure seemed possible

Maryland's Commissioner of Health

Dr. Rob't. H. Riley, Baltimore
Past-President and 1939 Host
Chas. J. Bruce, Superintendent Evitt's Cr. Water Co., Cumberland, Md.

from present indications. In the latter instance effluent recirculation had been especially advantageous in reducing the required depth of filter from 6 ft. to 3 ft.

F. S. Friel, Consulting Engineer, Philadelphia, in discussion, impressed with the flexibility of high-rate filtration, reported that he had under design such a plant to provide 1.5 hr. primary settling; 3-ft. deep filters to have a top loading of 2 lbs. B.O.D./cu.yd. of stone bed; effluent recirculation in the ratio of 2.5 to 1 of sewage received (assumedly a 24 hr. average); final settling providing 2-hr. average detention; and chlorination. Concerning temperature effects for low temperatures a larger area of

Hosts and Songster

"Wally" Spring, Distr. Engr., State Dep't. of Health, Salisbury, Md.
Clarke Gardiner, City Engr., Salisbury, Md.
"Gus" Requardt, Cons. Engr., Whitman, Requardt & Smith, Baltimore
("Prexy" Tawney, said he could sing, but the audience hadn't had the same brand of liquor.)

filter is required, the factor being 1.3 for sewage at 41°F. as against sewage at 77°F. Concerning recirculation ratios, Mr. Friel stated that such might prove a "movable feast" and the optimum would have to be determined for each individual case.

"Effect of the Washington Treatment Works on the Potomac River," by PAUL D. MCNAMEE, Chief Chemist, District of Columbia Treatment Works, Washington.

Mr. McNamee reporting the results from Washington's plant (providing primary treatment) in alleviating pollution of the Potomac River, presented a history of the condition of the river below the plant as revealed by weekly samplings. The plant removing 20 tons of B.O.D. and 12 tons of settleable and floatable solids daily reduces the population load of 900,000 to the equivalent of 600,000, which it was in 1936. [Consideration must, however, be given the fact that the settleable solids removal counts far more than the indicated oxygen demand reduction reveals when taken alone.—ED.]

No real test has been given the effect of the treatment because the river flow has never dropped to the critical point since the plant went into service. The worst condition before the plant went in was a condition of 15% D.O. saturation at 1,260 sec.ft. flow. Since operations started the lowest has been 34 to 40% for only 3% of the time, and this at the critical point 3 miles below the plant. As to the Coli index the Potomac must be considered unsafe for 15 miles below the plant.

Ralph E. Fuhman, Ass't Plant Sup't, pointing out that the river only about once in ten years drops to the flow wherein the present treatment will possibly prove inadequate, stated that the real test has not yet come. He directed attention to the value of three shallow river flats in regard to "decolloidizing" the Potomac and also in "manufacturing" oxygen, which is produced by shallow vegetative growth. A matter of more concern than D.O. values in the river is the sleek field below the outfall and it is planned to look into degreasing and better scum removal.

Ralph E. Tarbett, Sr. Sanitary Engr., U. S. Public Health Service, lamented the passing of Washington's largest flat, credited with producing about 20 tons of oxygen daily in summer. The remaining flat yielded only about 10 tons. Now the question was, what will be the river condition in 1940 and how soon will Washington have to provide more than primary treatment. In this picture the new plant of the Washington Suburban Sanitary District will have a distinct bearing—so it remains a case of watchful waiting for proof that more need be done to Washington sewage for the present.

Advances in Water Chlorination

The paper which A. E. Griffin of Wallace and Tiernan Co. was scheduled to give was not presented. The speaker was delayed in reaching the meeting and had his paper with him.

To fill the gap, *Harry A. Faber* of The Chlorine Institute was called upon to tell of progress being made in super-chlorination. He explained the meaning of "break-point" chlorination as nothing more mysterious than superchlorination to a point at which the residual (excess) chlorine takes a "nose-dive" toward the zero line, and things really begin to happen to by-products produced from a dosage of chlorine insufficient to create what we may term a "chlorine conflagration," brought about by super-saturation phenomena and a mass action effect. (These are not Mr. Faber's words, but our interpretation of his somewhat more scientific theory and hypothesis.—ED.)

In any event the chlorine does destroy the taste and odor compounds and to check any unknown water for its chlorination "break-point" Mr. Faber offered a simplified procedure which he distributed in mimeographed form.

He then outlined the several advantages from super-chlorination and told of its successful use at representative plants—notably at Indianapolis, where the mechanism of the process is under critical study by Calvert and co-workers, and indicating that so-called free-ammonia is completely destroyed and also much of the amino nitrogen goes with it when the saturation point is reached. Mr. Faber stressed the importance of adequate contact time if superchlorination was to prove most effective with the least cost. This period, he said, should be not less than 3 hours before dechlorination.

J. M. Jester, Sup't of Filtration, Washington Suburban Sanitary District, in a prepared discussion, related experiences in an attempt to determine the "break-point" of the water at his plant. He had found little indication of a "break-point" for the dosages 2 to 4 p.p.m., with contact periods less than 2 hours, but the period could be shorter for the higher dosages ranging to 7.2 p.p.m. on his particular water. From a careful study of odors, however, it was apparent that nothing less than a 3-hr. contact could be depended upon.

Based on his experiences, Mr. Jester said that he felt there was considerable to be learned about the process and more investigative work should be done before the process is advocated too strongly to the small plant operator.

Mr. Jester reported also on some experimental work in differentiating between chloramine residuals and true chlorine or hypochlorite chlorine.

"Ned" (E. H.) Herbert, Sup't. Water Dep't., Norfolk, Va.
A. L. Genter, Chemical Engr., Baltimore, Md.
Elwood Johnson, Sup't. D. C. Sewage Treatment Works, Washington

In these tests it was demonstrated that 5-minute boiling dissipated the whole of the residual, including the chloramine. He could get no results with starch iodide, which checked the differential test in which the true chlorine is destroyed with sodium nitrite and the chloramine remains unreduced.

"Keeping Iron In or Out of Solution," by LOUIS R. CAPLAN, Calgon, Inc., Pittsburgh, Pa.

Mr. Caplan, after a brief discussion of the theory to account for the fact that the addition of small dosages of hexametaphosphate to aggressive waters inhibits corrosion of iron or brass pipes, cited cases of record from amongst the 100 odd municipal and 80 industrial plants now applying 1 to 2 p.p.m. of this form of sodium phosphate (marketed under the name "Calgon") with effective results.

This compound, originally introduced to prevent scale deposition from water, has been more recently found effective in suppressing corrosion, first proven in industrial practice when the elimination of the protective scale was not followed by the corrosion expected. First introduced in cold water treatment "Calgon" had been applied for the primary purpose of holding calcium carbonate in solution and maintaining a high pH throughout the distribution system, at the same time checking subsequent precipitation in hot water systems. In time it was apparent that the "Calgon" alone had a definite inhibitive effect in itself. It seemed permissible to markedly reduce or discontinue the lime which, because of the high pH produced, caused attack on brass (dezincification), particularly in hot water systems. Experiments with a mixture of steel-wool and brass-wool demonstrated the effectiveness of Calgon alone, even in waters of pH value as low as 6. The following case histories were amongst those cited by Mr. Caplan.

Fairhaven, Mass., "Calgon" alone (1 p.p.m.) to a well water soft and high in CO_2 content, has since August, 1939, proved successful in checking red-water troubles caused by pick up of 0.3 p.p.m. or more of iron from the mains. (This case is more fully described by Robert Spurr Weston in a digest of papers read before A.W.W.A., which appears elsewhere in this issue. The same is true of the next case, as reported by E. C. Trax, before A.W.W.A.—ED.)

McKeesport, Pa., is now employing 1 p.p.m. dosage with lime to maintain 9.6 pH value.

Virginia Beach, Va., with a particularly severe condition started with 8 p.p.m. Calgon to secure a more rapid alleviation, since reduced to 2 p.p.m. Formerly a 5 p.p.m. iron pick-up had been observed on this system.

Hempstead, Long Island, finding lime alone not sufficient is now main-

State Sanitary Engineers
R. C. Beckett, (Del.); Richard Messer, (Va.); Geo. L. Hall, (Md.)
(All three high in their praise of the meeting.)

(1) B. G. LeMieux, Development Engr., The Fiber Conduit Co., Orangeburg, N. Y.; (2) Edgar F. Donaldson, Sup't. of Filtr., Annapolis, Md.; (3) M. F. Corin, Sales Engr., The Permutit Co., Phila.; (4) J. R. Cronnister, Mgr., Dorchester Water Co., Cambridge, Md.; (5) Ed Canton, Badger Meter Co., Balto. Md., (6) A. B. Millard, Chemist, Filtr. Plant, Ft. Meade, Md. (7) Donald S. Masson, Ass't. Maint. Engr. Washington Suburban Sanitary Distr., Hyattsville, Md.; (8) R. C. Willson, Sup't. Filtr., Hagerstown, Md.; (9) H. F. Watson, Engr., Link-Belt Co., Phila.; (10) C. D. Turner, Wailes, Dove-Hermiston Corp., New York City.

taining a pH of 8.0 and using 0.5 p.p.m. hexametaphosphate.

At a textile mill Zeolite softened water shows no iron pick-up since following the program of adding 8 p.p.m. dosage, since tapered off to 2 p.p.m. as routine.

L. L. Hedgepeth, Director, Technical Service, Penna. Salt Mfg. Co., Philadelphia, Pa., reported that his company employs "Calgon" regularly in boiler water treatment. To him the remarkable part was that so little of the product does so good a job; further, that the treatment was so simply and safely done in municipal and industrial plants. He likened the mechanism of corrosion alleviation to that of catalysis—little understood, but accepted on the basis of what is accomplished. The Hall Laboratories were to be complimented on the method and conservative procedure followed in introducing hexametaphosphate treatment in the municipal field.

J. G. Patrick, Chief Chemist, West Va. Pulp and Paper Co., Luke, Md., outlined many advantages accruing from the use of hexametaphosphate in the water supply going to a paper mill. It had reduced iron staining of pulp; kept the fine mesh screen cloth of the paper machine clearer of deposits; the wool felts retained their softness longer and had their useful life extended. These were amongst other advantages from inhibited corrosion or precipitation effects. He also mentioned other advantages from its application to industrial water supply, the most important being in laundries, bottle washing and condensers or heat exchangers.

Concerning attempted correction of corrosivity of the soft water supply of the West Va. Pulp and Paper Co., Mr. Patrick said that boosting pH value to 10.5 pH with caustic soda had not proved the answer. Decreasing the oxygen content of the water by reduced aeration and a lowering of pH value had proved the most effective scheme before "Calgon" treatment entered the picture.

"Some Contrivances Which Have Improved Operation of a Small Sewage Treatment Plant," by C. G. WEBER, Sup't, Sewage Treatment Plant, Annapolis, Md.

Mr. Weber, one of those "show-me" type of operators with a longish pointed nose indicative of inquisitiveness and inventiveness, thrilled his audience with a retinue of gadgets and operating kinks that made many envious, and all commendatory of what had been accomplished with so little material and ready money. (Since Mr. Weber's paper is to be printed in full in an early issue of this magazine only a sketchy resume will be given here.—ED.)

Mr. Weber, stating that he had found that in a plant operator's life it was the little things added up that count for a lot, proceeded to brief some of these "little things" and what had been done about them at Annapolis. The first thing was escaping chlorine at the point of prechlorination—corrected by installing a simple baffle arrangement. Most important, the chlorine requirement had dropped, thereby, from 20 p.p.m. to 13 p.p.m.—certainly to our mind 7 p.p.m. chlorine reduction was not to be considered a little saving. The next thing was an improvised grit-chamber (this is one of these all domestic systems) which had solved his pump sump and handling troubles of sludge from the digesters. On the crude sludge pump, gauges had been installed to reveal which of the valves were responsible (inoperative) when pump knock appeared.

A Couple "Half-Pints" and A "Tall One"

Here is one guy that is more "looked-up-to" than any member. Hagerstown's Sup't. of Filtration "Tiny" Willson (only about 6-ft.-5½) has been made official body-guard of presidents Tawney and Harrington. When they elect "Gus" Requardt he'll have to stretch further.

Seemingly the most important achievement of a money saving nature was Mr. Weber's study of handling and conditioning digested sludge and the vacuum filter operation and maintenance. This involved replacement of air-mix with a home-built mechanical flash mix, and direct transfer of conditioned sludge to the center of the filter vat. Thereafter, the elimination of lime completely, to produce an appreciable initial reduction in chemical cost of about $2.60 per dry ton of cake, plus tripling the life of the woolen filter cloths. This first step was later materially bettered when elutriation was tried, resulting in a further reduction of ferric chloride requirement from 4.6% $FeCl_3$ to 1.7%. For elutriation one 650 cu.ft. sludge storage tank was put to use and washing was performed with settled sewage (fill and draw method), the sewage by test proving superior as the wash-water to brackish estuary water, and almost equal to well water and much less expensive. The net result had been a cut in chemical cost from $7.88 per ton of solids to $1.69 per dry ton representing a saving of $6.19 per ton (78.5%), resulting from the successive improvements during a two-year period. In addition, power and labor had been cut in half due to in-

(1) R. Stuart Royer, Consulting Engr., Richmond, Va. and Wm. S. Coburn, County Manager, Chesterfield, Va.; (2) L. D. Shank, City Manager and H. R. Hancock, Sup't. Sewerage, Dover, Del.; (3) Edw. J. Lalor, Sales Engr., U. S. Pipe and Fdy. Co., who is taking over the territory of King Carrington, transferring to San Francisco; (4) Charlie Bruce, Sup't. and W. J. Edwards, Commissioner of Water, Cumberland, Md., and Jack Diven of The Leadite Co.; (5) Henry Salomon, who sells "Norit" carbon, and smiling Burt Graham, who says that it costs less when the customer gets it in "Black Alum" which his company sells; (6) N. D. Kenney, of Whitman, Requardt & Smith, Engrs., and F. A. Allner, Engineer Member of the Maryland State Board of Health.

crease in filter yield—now 8 to 10 lbs./sq.ft./hr. Also the blanket life had increased materially with the present expectancy of 300 tons of dry solids and 1,200 hours of service per blanket, costing $27 each.

For the elutriating water (settled sewage) a little Homelite Portable Pump is employed at an operating cost of 13 cents per day

Another highly useful "contrivance" at Annapolis is the "Weber Sludge Weigher" (so named by us) which is a self-dumping sludge cake collector. Set to release a dumping trigger at an exact weight of content, a counter reveals the number of trippings for the run. Thus a sludge weight recorder has been added at a cost of $3.50 for materials of construction; and, says Mr. Weber, it works like a charm to give us an accurate sludge record.

H. R. Hancock, Sup't of Sewerage, Dover, Del. (another Gadgeteer), said that there were just 3 classes of sewage plant operators. Class No. 3 was the job holder; Class No. 2 the operator who maintains a clean plant, produces gadgets and runs his plant as if it was his own property. Class 2 burns some midnight oil but feels repaid. Now the only difference between Class 2 and Class 1 is that the latter is capable of getting from his superior the funds he needs to do things with. "By these specifications Brother Weber is definitely a Class 1 Operator, and we are proud of him—his Mayor should be," acclaimed Brother Hancock.

A. L. Genter, Chemical Engr. of Baltimore, Md., in complimenting Mr. Weber on his initiative and inquisitiveness, credited him with the money saving discovery that settled sewage could be satisfactorily employed as the wash-water in elutriation. Like others, Mr. Weber had found that lime could be eliminated with benefit and a real saving. In cost, it must be remembered that use of 12% lime was equal to 3% additional ferric chloride. The ingenious flash-mixer at Annapolis is as effective as it is simple. Travel of the conditioned sludge direct and promptly to the vat center constituted a real advantage. In conditioning digested *activated* sludge, seemingly a hard beating following chemical addition is helpful, but only gentle handling is indicated for digested crude solids. Getting back to what he called the "lime myth," Mr. Genter said that at Ann Arbor, Mich., the 36% lime dosage had been cut out and now 3% FeCl alone is doing the work at a sizable saving. Concerning filter cloth life, a survey of 6 plants employing elutriation revealed that cloths last 6 times as long when the elutriation process is being employed.

"The Gunpowder Falls — Montebello Tunnel of Baltimore," by LEON SMALL, Water Engineer, Baltimore, Md.

Mr. Small, talking from lantern slides, gave a most interesting picture story of the completing phases of construction of the 7.5 mile long

(1) Burt Graham's nice new cattleman's hat from Kansas City was missing; Pittsburgh's clowning Ed Eyler was found modelling it while playing sandwich-man with the sign. (2) Here is the very camera-shy Engineer of New Castle County, Del., John W. Alden, (doesn't he look it?) and our helping persuader, to "try it just once," "Jake" Van Atta of Ralph B. Carter Co. (It really didn't hurt, did it Mr. Alden?)

12-ft. diameter tunnel connecting Loch Raven Reservoir with the Montebello Filters. The concrete used in the lining was pumped 160 ft. to the forms at record rates of 30 yds./hr. placement. Highly interesting was the method used in placing the ½-in. plate 12-ft. diam. steel pipe in the lower 2 miles of the tunnel. These 16-ton sections (40 ft. long each) were lowered through 160-ft. deep shafts. At the bottom they were swung to horizontal and strapped to trucks on the rails. The locomotive then pushed these sections into position—some as much as two miles. The feat was far from simple when realizing that the clearance between pipe and tunnel walls was only 2½ in. The space was later filled with grout and the pipe interior lined with gunnite applied on 4x4 mesh No. 10 wire. The 1,900-ft. extension of the steel pipe, in open cut, was lined with Bitumastic Enamel.

Mr. Small pictured some of the difficulties encountered which have netted a full year delay in completion. One was the case of the high ground water pressure pushing in the ½-in. wall pipe from above. This required cutting to relieve the pressure and bolting into place. Check valves, opening inward, were thereafter inserted to preclude further occurrences. The tunnel is now scheduled to go into service in the Fall of 1940, extra work adding 0.6% to the cost.

J. R. McComas, Ass't. Engr., Md. Dep't. of Health, pointed out that Baltimore's all gravity tunnel would prove a handsome investment to the city, when considering the $70,000 annual low lift pumping cost to be eliminated at the Montebello Filter Plant. When capitalizing this saving and deducting the P.W.A. grant, one could figure that the actual net cost to Baltimore would prove to be about 5 per cent of the total invested, thus proving its self-liquidating character.

"Behind the Water Tap"

The curtain rang down with a showing of the interesting colored movie, made by Industrial Chemical Sales Company, to reveal "What's Behind the Water Tap." Naturally, busy chemists were pictured in their work of producing the best possible product for consumers with activated "Charcoal."

And, once more we wish to say that it was a splendid meeting; may there be many more like it.

CLEAN FILTERS!

A Year's Experience With the Palmer "Filter Sweep"

By E. C. GOEHRING
Chemical Engineer
BEAVER VALLEY WATER CO.
BEAVER FALLS, PENNA.

THE proper maintenance of the sand beds in filters is a problem that is found in most filter plants, and satisfactorily solved in but few. Mudballs, sand coatings, bed shrinkage from side walls, surface cracks and hard spots in the lower bed are evils that practically all operators have to cope with at one time or another.

Many remedies have been proposed in recent years for correcting or minimizing these troubles, but none in the writer's opinion have produced such results as have been obtained by the installation of the recently perfected Palmer "Filter Sweep." This device not only clears up these troubles, but also maintains the beds in as perfect condition as one might wish for. If this statement appears to be a "plug" for the "Filter Sweep" let it be so. The results justify as much.

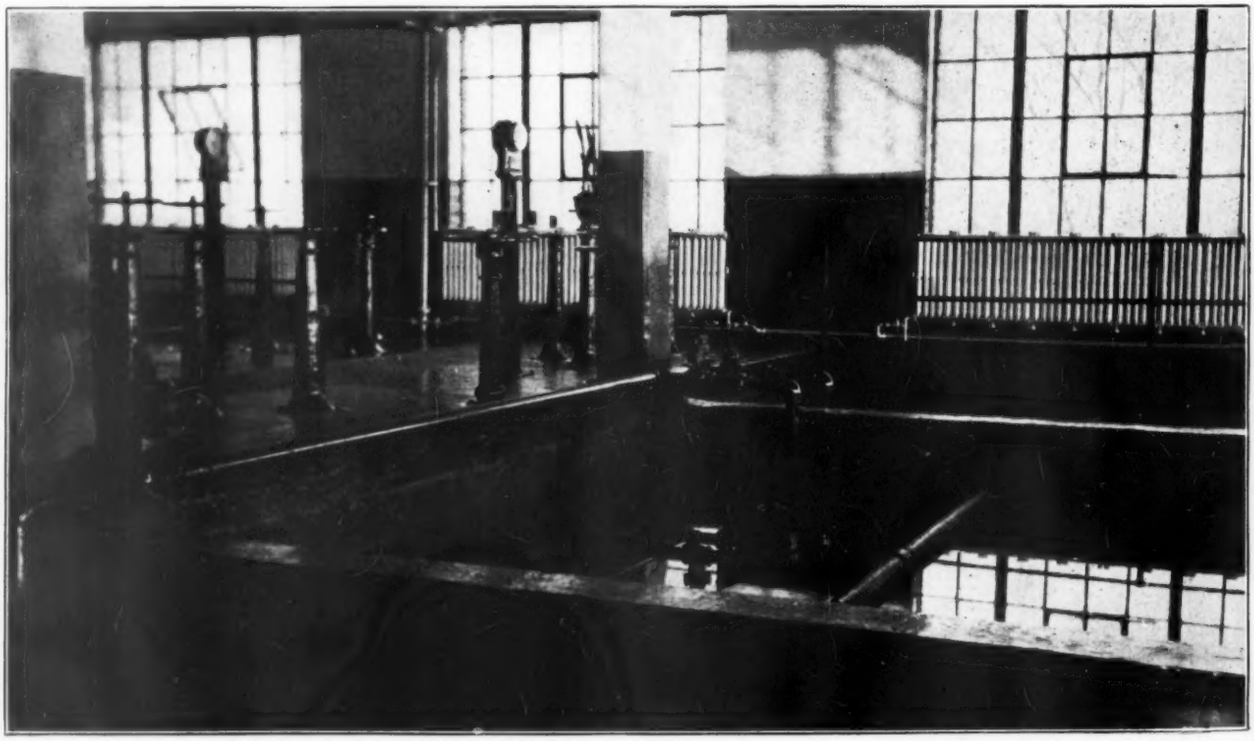
The Author

The Eastvale plant of the Beaver Valley Water Company has six units of one million gallon capacity each, and of rather an unorthodox shape; namely, 25½ by 14 feet. When this plant was designed, in 1922, a wash water rise of 12 to 15 inches was considered adequate. Two reinforced concrete wash water troughs running lengthwise, having a total cross-section area of two square feet, were provided to carry off the wash water coming from a 50,000 gallon tank providing a maximum head of 11 pounds static pressure.

Some Operating Experiences

After several years operation, it was found increasingly more difficult to maintain the sand beds in the proper condition, and considerable maintenance had to be used to remove hard spots, to prevent cracks, and sidewall shrinkage. This required passing the sand through a jet washer at least once each year, and thereafter intermittent shoveling and hosing with high pressure nozzles between the scouring jet washes.

In 1936, when higher wash rates and increased sand expansion were being advocated as effective means of sand bed conditioning, a larger wash



Eastvale Filter Plant, showing pipe header and control valves on Palmer "Filter-Sweep" installion.

water tank was installed at a higher elevation to give higher rates of wash. Rates of vertical rise as high as 40 inches per minute were available with the new tank, which has a capacity of 70,000 gallons. While these higher rates helped to keep the hard spots smaller, flooding of the small capacity troughs made our higher rates relatively ineffective.

The Beaver River, which is our source of supply, fluctuates widely in its characteristics, especially in color, taste, and odor. The color comes from the newly created Pymatuning Reservoir at the headwaters of the Shenango River. The taste and odor problem originates in the Mahoning River, which flows through the Youngstown, Ohio, area, where phenolic wastes from the coke by-product plants enter. Increased use of activated carbon has been necessary to minimize these tastes and odors. During the past two years abnormally high dosages, ranging to well over 1000 pounds per million gallons, have been required at times.

The increased use of carbon has resulted in increasing the problem of keeping the filters in good condition, and required more frequent washing to prevent passage of the carbon to the clearwell.

The graph, showing the average carbon dosage in pounds per million gallons, indicates clearly the effect on the number of filters washed, particularly before the installation of the Palmer "Filter Sweeps." To anyone who uses carbon, it need not be mentioned that the filter mat becomes unusually sticky and most difficult to remove. Our experience was further complicated by the addition of lime to the filters for pH adjustment during periods when high organic color was present in the river.

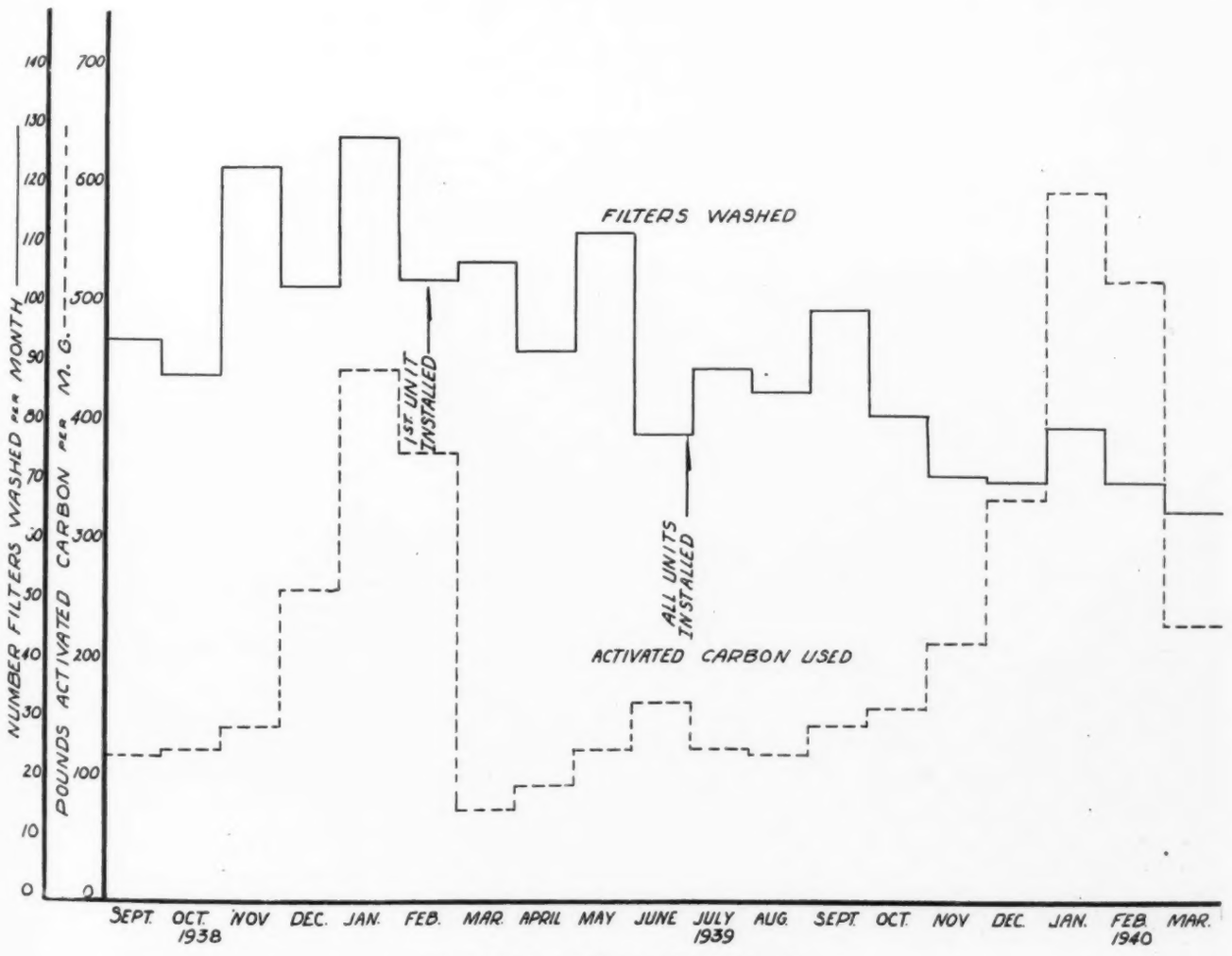
During periods of high colored raw water, coagulation on the acid side is required, and lime is withheld for addition just ahead of the filters for pH adjustment. The combination of high carbon dosages and lime on the filters brought about the appearance of large numbers of black hard balls, which were light enough to remain in the upper six-inch sand strata. Attempts to wash them out by ordinary means failed, and only screening effectively removed them.

Some Filters Overhauled and Experimental "Sweep" Installed in Another

In November and December, 1938, two units (Nos. 1 and 2) were completely overhauled and the sand and gravel replaced with new media. A program was set up, at that time, to replace the beds in all of the units.

In January, 1939, the opportunity presented itself to install one of the new Palmer "Filter Sweeps." This demonstration unit was installed in No. 6, which was the next unit scheduled for replacement.

After about two months' use of this jetting sand bed agitator, it was noted that the filter improved to the extent that former hard spots were removed and small surface cracks no


NUMBER FILTERS WASHED PER MONTH
POUNDS ACTIVATED CARBON PER M. G.
FILTERS WASHED
1ST. UNIT INSTALLED
ALL UNITS INSTALLED
ACTIVATED CARBON USED
SEPT. OCT. NOV DEC. JAN. FEB. MAR. APRIL MAY JUNE JULY AUG. SEPT. OCT. NOV DEC. JAN. FEB. MAR.
1938
1939
1940

Filter Wash and Carbon Feed Record

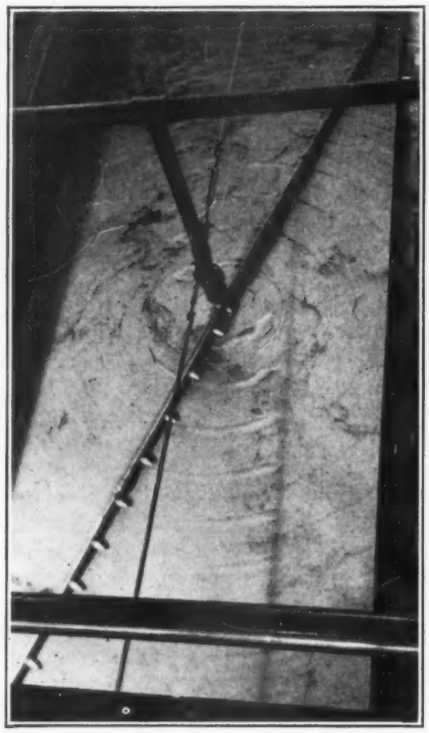
Indicating the effect of the "Filter Sweep" in producing cleaner beds and lengthened hours of filter service between washes. More impressive is the record in the face of heavier carbon loadings since the "Sweeps" were installed

longer showed up. The sand began to lose its "sticky feel" and became brighter in color. At the same time, it was noted that No. 1 and 2 units, with the new sand, were becoming infested with "raisin-like" spongy balls of carbon and lime, along with alum floc and algae. The apparent benefit that No. 6 was receiving from the agitator prompted us to install Palmer's "Sweeps" in all of the units. This work was completed in June, 1939.

During the experimentation with the first unit, it was found that better washing could be obtained by increasing the carrying capacity of the wash troughs. We bolted steel plates to the outsides of the concrete troughs, which increased the free-board 6 inches and increased the effective cross-section area of the troughs from a total of 288 square inches to 508 square inches. This increase made it possible to use wash water rises up to 20 inches without flooding the troughs.

It was also noted that a sand expansion of from 10% to 15% was sufficient to make the washing effective when using the "Sweeps", whereas, before, expansion as high as 40% to 50% did nothing more than allow the balls to bob up and down more and to settle deeper in the sand itself.

An almost immediate improvement was noted upon the complete installation of "Sweeps" in all the units, especially in the new sand units (Nos. 1 and 2), which became entirely cleared of the "raisin-like" balls in a short time. Moreover, these filters have remained *as clean as the day the sand was installed* over sixteen months ago.



After filter had been backwashed. The shallow grooves in sand caused by rotating agitators from draining of supply line. Note how clean this bed is even though carbon is used.

In the four filters with the old sand, the results have also been remarkable in that the former sticky and surface crack conditions have been removed. The sand now is clean and bright. Due to the use of the "Sweeps" in these units, further replacement with new sand has been indefinitely postponed, resulting in a considerable saving in labor and material cost. Periodic inspections indicate that the beds and the sand are continually improving.

Wash Water Economy

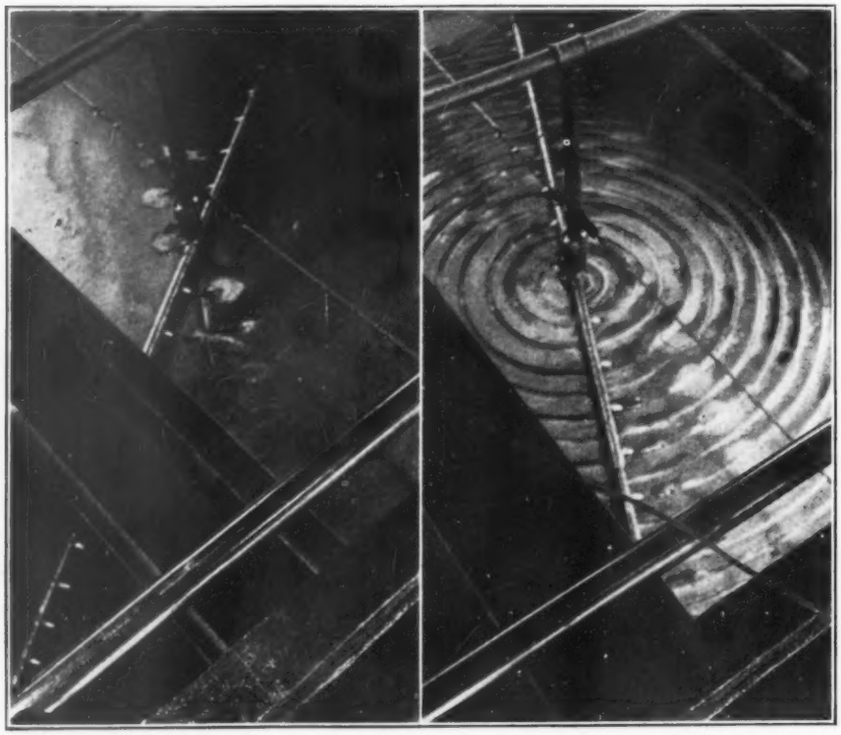
During the past year's experience with the Palmer "Sweeps", no attempt has been made to economize on the amount of water used per filter wash. However, a considerable economy has been effected in that the number of filters washed per month has dropped considerably. The accompanying graph indicates the drop in numbers of filters washed very effectively, in spite of the fact that carbon dosages have been increasingly higher than during a like period prior to the installation of the "Sweeps." The decrease in the number of filters washed is indicative of the increased lengths of runs between washings resulting in a saving in wash water in addition to other advantages from longer filter runs.

A typical example may be cited on the graph. Comparing January, 1939, with January, 1940, indicates a 38% reduction in number of filters washed. This, in spite of increased carbon dosages of 444 pounds per million gallons in January, 1939, to 593 pounds per million gallons in January, 1940.

We have every reason to believe that, inasmuch as this past year has shown a considerable reduction in wash water, the reduction should be increasingly more, in the future, as the past year has been the cleaning period during which the beds have been continuously improving.

The "Filter Sweep"

The pictures of the "Sweep" indicate the nature of the device, which is substantially like the old mechanical rakes, except that instead of wooden or steel teeth, jets of water do a better stirring job. The jets are set in a horizontal arm which revolves like the conventional lawn spray, or the revolving distributor on modern sewage filters only at a much more rapid rate. The nozzle pressure is about 50 pounds per square inch, and, even with the sand bed not expanded, the jets penetrate as much as four inches into the sand. The pictures



(Left)
Dirty filter drawn down before starting agitators, and backwashing.
(Right)
After agitator had been turned on, showing grooves cut in sand.

show the effectiveness with which the area of the bed is covered by the jets; but only one of the two revolving arms with which each filter is supplied is shown. It is particularly significant to find that the corners of the filters, as well as other segments not directly under the revolving arms, are effectively agitated by jets in the ends of the arms. Our experience has been that the corners on the new sand units are as clean as the remainder of the bed; but during the beginning of the use of the agitators on old sand, an occasional shoveling of the corners toward the center helped to replace cleaner sand in these areas. After the first two months' use of the agitators this shoveling operation was no longer required, and has not been since.

Determining Most Effective Use

The operation of the agitators, in conjunction with the usual washing procedure, was modified from time to time to arrive at the procedure which gave the best results. When a unit is ready to be washed, the filter is drawn down until the water level is even with the jets. The agitator water supply valve is then opened and the agitator made to revolve for one minute. This breaks up the surface mat and makes a heavy slurry of the material usually found on and near the bed surface. This operation has proved an important part of the procedure. The wash water valve is then opened to give the necessary volume to *just fill* the troughs. The agitator is allowed to rotate for from three to four minutes during the bottom washing period before the high pressure supply to the "Sweep" is shut off. We have found that with not more than 10% to 15% expansion, the agitators are completely covered with sand and the jets penetrate into the lower sand layers. Washing is continued until the filter is as clean as experience indicates is consistent with practice for best initial filtration efficiency.

In some cases, especially when the agitators were first installed, it was found almost impossible to "clear up" the filter as long as the agitators were in operation. This definitely indicated the freeing of foreign matter not ordinarily removed in the usual washing procedure. Now, since the filters have become more truly clean, the beds can be washed to a "clear-up" point (meaning clarity of wash-water leaving) with the agitators in operation during the entire washing period. The major objection to this procedure is that when the agitators are shut off *after* the bottom wash-water, upon drawing the filter down, it will be found that the sand will be in a saucer-shaped contour instead of perfectly flat. The writer has observed as much as a six-inch difference of elevation between the sides and the center of the filter, enough to stop the agitators when the wash water was shut off before the agitators. This indicates that during the agitation period a very pronounced sand recirculation from the side walls and corners to the center must be taking place in the bed; a feature which commends this device over the stationary surface wash jets.

Summary

The past year's experience with this form of surface agitation device indicates to the writer that such troubles, as mudballs, surface cracks, bed shrinkage, hard spots, and sand coatings removable by abrasion, if the underdrains of a filter are not clogged, can be effectively removed and the beds maintained in good condition. A definite economy in the use of wash water can be expected after the beds have been cleaned.

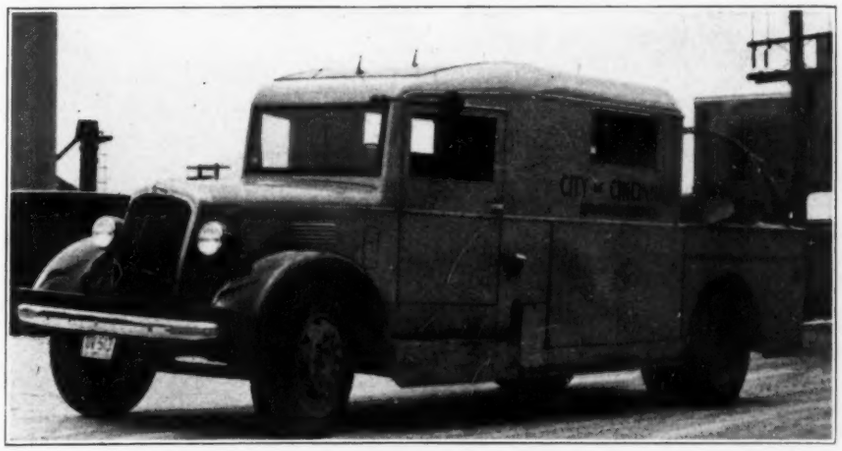
The writer's experience with the Palmer "Filter - Sweep" prompted him also to recommend the installation of four units in the Shenango Valley Water Company's filtration plant at Sharon, Pennsylvania, where they are now operating with complete satisfaction.

Cincinnati Boasts Two Radio Equipped Sewer Service Trucks

For the picture shown we are indebted to C. E. Brokaw, Sup't. of Maintenance, Dep't. of Public Works, Cincinnati, who gives us the following information after having seen the artisle by Edward P. Decher —"Sewer Service and Maintenance" in our September 1939 issue, which featured a radio equipped sewer service and maintenance truck believed to be the first of its kind in the United States. Mr. Brokaw writes as follows:

"The City of Cincinnati has in its service two specially constructed sewer trucks which were radio equipped in June of 1939. We are enclosing a photograph of one of these trucks, which as you see has been specially designed and equipped for sewer cleaning service of an emergency nature. Very often these trucks are routed throughout the entire day by radio calls broadcast over our regular police broadcasting station."

Cincinnati has gone The New Jersey Joint Meeting one better and has two maintenance trucks radio equipped.



One of Cincinnati's Two Radio Equipped Sewer Trucks.

ARIZONA SEWAGE AND WATER WORKS ASSOCIATION

Holds 14th Annual Meeting in Tucson

By A. M. RAWN,* Associate Editor

INCLUDING a number of out-of-staters, eighty members and guests registered for the fourteenth annual meeting of the Arizona Sewage and Water Works Association on April 19, 20 and 21, in Arizona's dude ranch capital, Tucson. (In case you don't yet know, that name is pronounced "Two-saw'n" by the real and synthetic cowwaddies of the wide open spaces.) The meeting followed close on the heels of that of the Arizona Public Health Association held in Tucson the 16th, 17th and 18th.

At a business meeting held preliminary to the technical sessions on Friday, April 19, the Association concluded among other things, that it would for the present take no active part in the formation of a national sewage works association; appointed a new committee on Professional Registration for Sewage and Water Works Operators, and elected the following officers:

President—A. W. Miller, Johns-Manville Co., Phoenix.

1st Vice-Pres.—G. A. Rhoads, Engr. of Utilities, Safford.

2nd Vice-Pres.—Geo. W. Seeley, City Manager, Tucson.

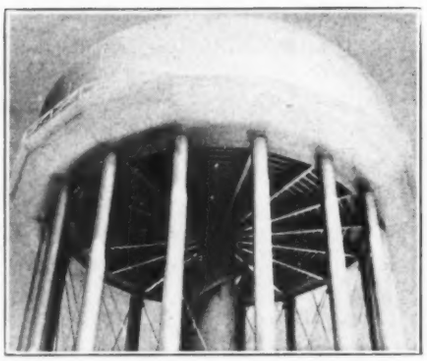
Secy.-Treas. F. C. Roberts, Jr., State Sanitary Engr., Phoenix.

(To the latter your reporter is indebted for considerable assistance in gathering material utilized in preparing this report.—A. M. R.)

Safford was voted as the place for the fall meeting, with Yuma a close contender.

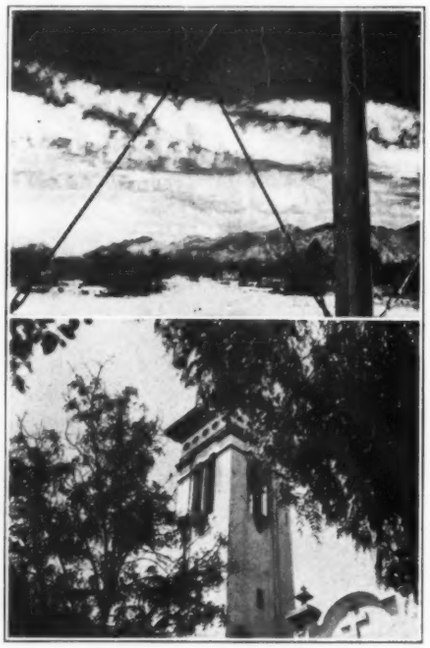
Sunday Devoted to Inspection Trip

Nineteen papers were presented at the four technical sessions held on the 19th and 20th at the Santa Rita Hotel. Festivities included a dinner meeting the evening of the 19th; and a dinner-dance the evening of the 20th at the All-States Club. Sunday morning, the 21st, was devoted to a caravan of inspection of the water and sewerage facilities of the City of Tucson. [Easterners take note of this post-convention inspection trip made on Sunday morning—and glimpse what follows.—ED.]



One of Tucson's Two New Tanks.
Each of 1,000,000 *Gals. Capacity.*

The Arizona Association boasts only 80 members. Eighty members and guests registered—105 were present at the Saturday dinner meeting; the average session attendance was 59, minimum 48, and maximum 70.



Just a Bit of Photography.
Arizona Hills From Beneath the Water Tower. Santa Cruz Belfry Through the Pepper Trees.

Technical Sessions

(Pres. Phil. J. Martin, Jr., Presiding)

"Design and Operation of Submersible Pump and Motor," by J. B. Griffin and D. W. Conklin, Byron-Jackson Pump Company, Los Angeles.

The paper stressed safeguards in the operation of pumps manufactured by the company represented by the speakers. Diagrams relating to characteristics of flow and economy were distributed to the members and the economics of the "submersible" pump's application in the deep wells encountered in the southwest was discussed at length. The speaker stated that the absence of the customary long shaft made this one of the few types of pumps which may be installed in a crooked hole.

"Why the B. Coli Group?" by R. A. Greene, Ph.D., Director, Arizona State Laboratory, Tucson.

The Doctor reviewed the history of the bacterial examination of water, stated that it being impracticable to test waters for the pathogenic organisms directly, the organism B. Coli was decided upon as an indicator of the presence of pollution emanating from the intestinal tract of man. It is the best known test for the potability of water, and the laboratory usually reports its presence or absence without any effort to separate into fecal and non-fecal types, knowing that any error is always on the side of safety.

"Stray Current Electrolysis, Its Causes and Methods of Prevention," by Robert R. Ashline, Electrolysis Engineer, Los Angeles Bureau of Water and Power.

Corrosion of underground metal structures occurs from stray currents and soil corrosion. Stray current electrolysis is quite universally caused by the use of d.c. for power in electric railroad systems. Unfortunately, rail sizes of street railways have not been increased to accommodate extended loads, and a large part of the return current is carried by water pipes and

*Ass't. Chief Engineer, Los Angeles County Sanitation Districts, Los Angeles, California.

the like, which undergo electrolytic destruction where the current leaves the pipe. Constant destruction of the water lines is going on because the pipes have not always been protected with adequate coating, nor is there sufficient bond of joints to provide adequate drainage of the current put in the mains. Cooperative drainage of stray currents from all utilities has assisted in the solution of the problem. Care in coating and excessive care in backfilling the trench, as well as the increase in rail sizes, are of great assistance.

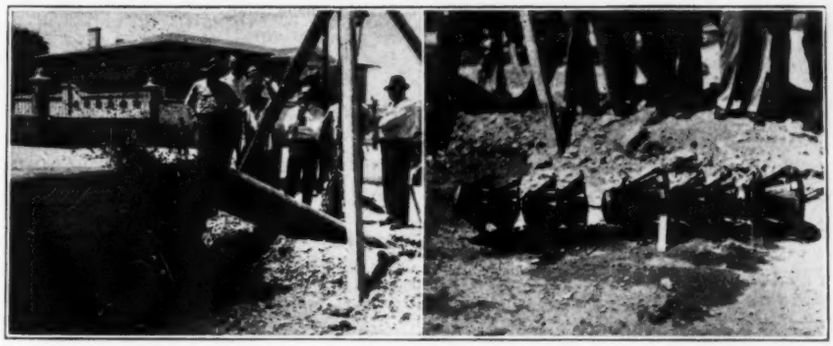
"Water Problems of the Southern Pacific Railway Through Arizona," by A. J. Gilbert, Water Service Foreman, Southern Pacific Railway Company, Tucson.

The speaker related the history of the development of water supplies in Arizona, stating that 1916 was the peak development year. He then described the series of wells drilled along rights-of-way, stated that the water therefrom subsequently had to be softened in the interests of locomotive boiler protection and, among other interesting comments, said that soft water will produce a saving of from four to nine thousand dollars per year per locomotive and that 120 locomotives were in use on his division. For every pound of scale formed in the boiler of a locomotive, it has been computed that the cost to the company is thirteen cents.

Measuring Flows

"Flow Measurements of Water and Sewage," by Lee H. Chamberlain, Manager, Water and Sewage Works Sales, Crane Co., Chicago.

Mr. Chamberlain presented an excellent discussion of liquid measuring weirs, Venturi tubes, flumes and orifice plates. These he listed in the following order of applicability to wide variations in quantity flow of (1) triangular weir, (2) Venturi flume, (3) rectangular and cippoletti weirs, (4) orifice plates, (5) pitot tubes, Venturi tubes and flow nozzles. He stated that the presence of solids in sewage alters the situation and places the Venturi flume type of measuring device in a definite position of vantage for such work.



"Thar She Blows!"
A demonstration during the main cleaning project under way in Tucson. Snapshot on left (not so easy to get) shows the "go-devil," pictured on right, shooting from the 12-inch main. Pipes laid 1905 being cleaned now for first time by the Flexible Underground Cleaning Co. method.

"The New Sewerage System of Wilcox," by Robert M. Cushing, ing, Headman, Ferguson & Carollo, Phoenix.

This paper, descriptive of the recently constructed Wilcox, Ariz., sewerage system, related facts concerning construction and other difficulties facing the consultant and contractor in such building. Mr. Cushing commented specifically on the efficacy of the beach ball method of sewer cleaning for removing sand and other materials from newly constructed lines. [The method, developed on the Los Angeles County System, is described in the 1938 Reference and Data Issue of this magazine.—ED.]

"Repair of Water Meters as Practiced in the Smaller Plants of the Southwest." by Sidney S. Small, Western Manager, Worthington Meter Co., Los Angeles.

Mr. Small's very instructive paper described meter repair facilities to be found in smaller plants. He said that in many Eastern plants, meters are tested and checked for needed repairs every two years, while in Arizona and California the methods vary from a 5-year inspection to letting the meter run until it stops. He directed attention to the fact that sand, sediment excessive southwestern heat, backing in of consumer's hot water supply, meter overload, galvanic action corrosion, damage by trucks, etc., are the principal causes of meter failure. He recommended complete disassembly of the registers and all moving parts when the meter is repaired, and a thorough check before reinstalling.

"Water Hammer," by Richard Bennett, Chief Designing Engineer, City Engineer's Office, Phoenix.

"Water hammer," was explained by Mr. Bennett, as the surge caused by stoppage or reversal of flow so as to cause the water to rebound. The force of this impact results in the destruction of pipelines and fixtures, a situation which will not be corrected by the quick-closing valves now being offered. Mr. Bennett then described the best known cone-type check valves, relief valves and so-called surge suppressors aimed at suppressing or eliminating this hydraulic manifestation. He recommended study of any local water hammer problems through use of the chronomatic drum, which will register pressure and time. These devices are employed to record cylinder pressures on Diesel engines and may usually be secured through Diesel engine dealers or users.

(1) *Richard Bennett, Chief Designing Eng., and Ira W. Bellinger, Sup't. of Water, Phoenix*; (2) *George W. Seeley, City Manager, Tucson (newly elected Vice-Pres. of the Association) and Phil F. Morgan, Chicago Pump Co., Chicago;* (3) *Mesa's City Engineer, E. B. Tucker and the Association's 1st Vice-President, G. A. Rhoads, Engr. of Utilities, Safford, Ariz.*

High-Rate Biofiltration

"Biofiltration Sewage Treatment Process," by Earl M. Kelly, Western Manager, The Dorr Co., Los Angeles.

Mr. Kelly illustrated his remarks with a variety of pictures which indicated the flexibility of high rate trickling filter process he was explaining. In addition to directing attention to the economies inherent in this process of treatment for certain types of sewages, Mr. Kelly told of the excellent results being obtained where the method is in use, and emphasized the wide applicability of the method, and its ruggedness and flexibility which renders it attractive in industrial waste treatment and seasonal variations in loadings.

"Comminution of Sewage Screenings," by Phil F. Morgan, Sanitary Engineer, Chicago Pump Co., Chicago, Ill.

The speaker traced the development of the sewage comminutor step by step, and told how experience had indicated changes and alterations in the equipment design, until the present Chicago Comminutor in sizes from 7 to 36 inches in diameter, handling flows from 350,000 to 25,000,000 G.P.D., will chop up almost anything which floats down a sewer, excepting golf balls. Mr. Morgan described the use of the comminutor, with slot widths 3/16 to 1/3 inch, as enabling the elimination of bar screens, and stated that the necessity for a grit chamber ahead of the Communitor depended quite largely upon whether the sewerage system was separate or combined. He also stressed the policy of his company in respect to designing the machine to fit the individual job as nearly as permissible.

Tucson Gets Two New Tanks

"Construction and Fabrication of Elevated Steel Water Storage Tanks for Tucson," by J. August Rau, Chief Designing Engineer, Allison Steel Manufacturing Company, Phoenix.

Two elevated steel storage tanks, each of 1,000,000 gallons capacity, now serve the city of Tucson. The speaker described the one located to the north of the city, revealing that it had been designed locally and manufactured in Phoenix. Care was taken not to include any of the patented features protected by tank companies, and, in contradiction to many which carry a patented design, the center riser (8-ft. diam. of ½-in. plates) carries one-third of the structure's nine million pounds total load, the remaining two-thirds being divided equally among 16 columns located circumferentially. The tank is 85 ft. high, 90 feet in diameter, has a water depth of 25 feet. As a structural feature, all joints are electrically welded.

[An article describing improvements recently made to the Tucson water system is scheduled for an early issue of this magazine.—ED.]

"The Present War's Influence Upon European Sanitary Practices," by A. M. Rawn, Assistant Chief Engineer, Los Angeles County Sanitation Districts.

This topic, presented at luncheon on Saturday, related to conservation of sewage for irrigation in certain European countries hard pressed for crop production, the advantages of stored coal in trickling filter beds, the use of compressed sludge gas as a substitute for petrol, effects of fluctuation in population on water and sewerage facilities, and sanitation of air-raid retreats. The speaker then reviewed sanitary conditions in northern Africa and Assyria, and directed attention to the fact that many of the improvements which are current in America find no counterpart in European and Asiatic countries outside of the principal European countries and Great Britain.

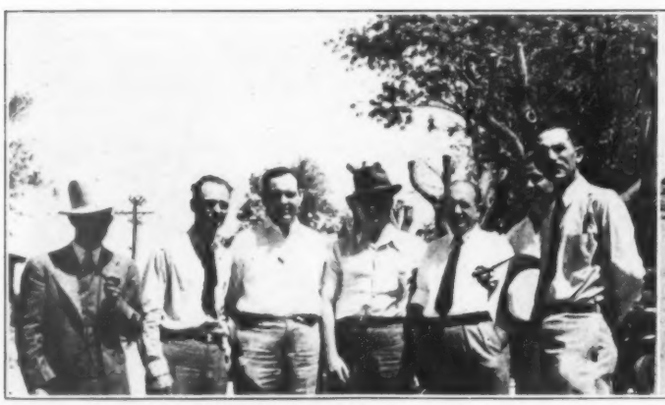
Water Service Beyond City Limits

"Water Service Outside of Municipal Corporate Limits," by Ira W. Bellenger, Water Superintendent, Phoenix.

Mr. Bellenger's discussion dealt with the economics of delivering the water to consumers outside of corporate limits, and related the policies of the City of Phoenix, where charges to such users are 50% higher than within the city. The City's objective is to purchase and include all adjacent water supplies in the city department and to control and protect the water service in and about the corporation. Pending legislation, which is aimed at placing certain portions of the city's utilities beyond the corporate limits under the State Corporation Commission, was deplored by the speaker. He said that no small amount of profits accrues to the water department from the sale of its services to outside consumers. Subsequent discussion of this paper developed the familiar phase which usually appears, to-wit: that protection of public health within the city depends, at least in some measure, upon similar protection in its immediate environs.

"Mapping a Municipal Water System," by E. B. Tucker, City Engineer, Mesa, Arizona.

This mapping project was a W.P.A. job, and the commendable manner in which it was accomplished redounds to the credit of the City Engineer's office in Mesa. The job was



(1) *From left—Harry Hanson, Sup't of Sewerage, Wickenburg; Robert Cushing, Headman, Ferguson and Carollo Engrs., Phoenix; F. C. Roberts, State Sanitary Engr., Phoenix (Sec'y.-Treasurer of the Association); Bernard Schiller, County San. Engr., Yuma; H. H. McLeod, Inspiration Copper Co., Inspiration; John C. Park, Professor of Civil Eng., Univ. of Arizona.* (2) *Snapped on the Sunday A.M. Tour of Inspection*

mostly done by a white-collar class of W.P.A. workmen, the total cost to the city of Mesa being estimated by the speaker at $500, roughly. The result is an excellent mapped record of the otherwise uncharted water system of the city of Mesa, and is proving of inestimable benefit in layout and design of extensions and improvements.

"Sewerage Service Lines Between the Home and the Lateral Sewer," by George W. Seeley, City Manager, Tucson.

Mr. Seeley stated that all house connection lines in the city of Tucson were by ordinance constructed of cast iron pipe, and said that the lines were laid on a minimum grade of one-quarter inch per foot, and that the only joint construction other than lead was at the connection to the lateral sewer, where the pipe was completely encased in concrete. "G. K." Joint Compound had been found an effective material in excluding root penetration into laterals and house connection lines.

"Underground Waters and Their Development in Arizona," by Harold Schwalen, University of Arizona, Tucson.

Professor Schwalen described the geographical location of all known extensive underground water strata in the State and issued a word of warning relating to the tremendous present overdraft on these supplies. At the present rate of underground water depletion, many of the sources now used for irrigation will be uneconomical in the not distant future.

SOUTH JERSEY SEWAGE OPERATORS

Inspect Experimental Ozonation Plant

On Saturday afternoon, May 11th, the South Jersey Sewage Operators' Association, at one of its monthly meetings, featured an inspection of the experimental and demonstration plant of Ozone Processes, Inc., in operation at the Moorestown Sewage Treatment Plant. There they saw ozone being produced and fed to sewage for the purpose of securing deodorization and partial oxidation in conjunction with chemical precipitation.

Following the inspection, Messrs. J. M. Daily, Engineer, Ozone Processes, Inc., and George Eisenberg, Research Bacteriologist, explained the process, the aims of the experimentation, and the ozonation equipment.

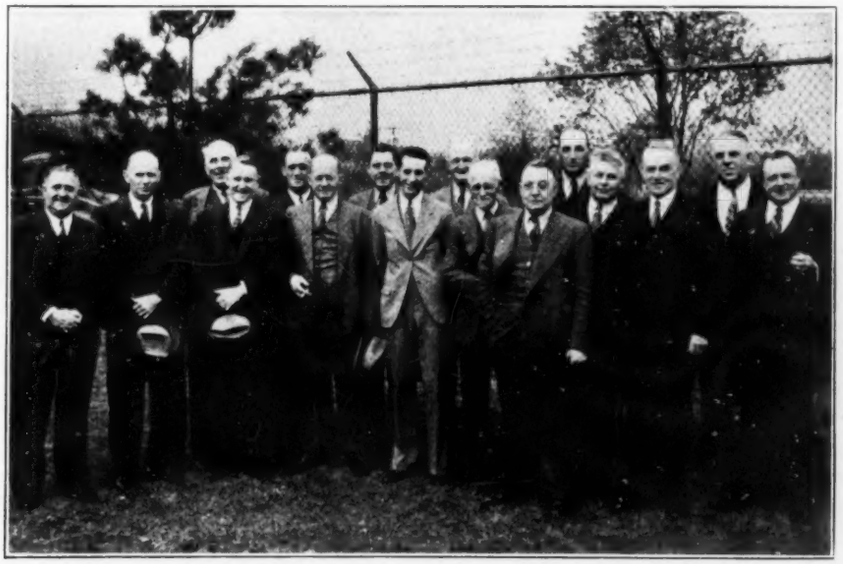
Mr. Eisenberg, explaining that ozone is so sparsely soluble in water (400 times less so than oxygen) it was necessary to work with very dilute solutions, necessitating the large ozonizing (dissolving) unit. To the Moorestown sewage 2 p.p.m. preozone and 8 p.p.m. post ozone dosages are now being applied, with 12 minutes of contact through the ozonizing units in each case. The sewage, clarified by chemical treatment, is treated to insure 0.3 ± residual ozone after the 12-minute contact, resulting in essentially complete b. coli destruction and destruction of some of the organic nitrogeneous compounds.

Mr. Daily, inventor and designer of the equipment, then described the ozonator and ozonizer units. The electrified air leaving the ozonator contains 0.5% ozone at a power consumption of 7 K.W.H. per pound of ozone produced. To this power for the air compressor, water for cooling, driving the agitator in ozonizing units raises the total power to between 9 and 14 K.W.H. per pound. The ozonator is marketed as one size unit with capacity at from 3 to 10 lbs. per 24-hr. rate by altering voltage input.

Mr. Daily explained that the end sought in the Moorestown work was that of developing a combination chemical precipitation and filtration process which, with ozonation, would produce 85 to 90% oxygen demand reduction in an inexpensive compact plant free of odor nuisance and subject to close-in locations. The cost to date at Moorestown appeared to be $10.00 to $15.00 per million gallons for coagulants and ozone. The ozone appeared quite helpful in the flocculation stage because of its oxidizing power and the 12-minute violent mix.

Questioned as to the cost of sufficient ozonation equipment for a 1 m.g.d. operation, feeding 10 p.p.m. ozone, Mr. Daily said that each 10-lb. capacity unit would cost roughly $10,000, but that for large plants $50,000 per m.g.d. capacity should cover the cost of all ozonation equipment. Naturally, for the small plant the ratio per m.g. would be higher. (If we followed him correctly, not less than 9 units would be required for a 1 m.g.d. plant.—ED.)

Following the Technical Session a tasty South Jersey Turkey Dinner (believe it or not; at 60 cents per head, and seconds to any who could eat more) was the closing "order of business." The more we see of these small group meetings the stronger we are for them, and the South Jersey Operators' meeting proved no exception.



Early Arrivals at Moorestown Plant

President Wm. R. Lafferty (Lakeland) on extreme left; Sec'y. Benj. I. Corson (Oaklyn) fourth from left; Host "Ed" P. Hyland (Moorestown) third from right.

10th ARKANSAS WATER AND SEWAGE CONFERENCE THE BEST

(A Report of a "Music With Few Words" Variety)

LAST year a calamity befell us and we had to print a report of the Penna. Water Operators' Assoc. as one of "Words Without Music." The missing "Music" being the absence of pictures, occasioned by a disaster in developing and loss of the complete lot of films on which the interest-adding meeting snapshots were made.

The New Chairman
D. Y. McDowell
Supt. Water & Sewerage
Malvern, Ark.

Elected Vice-Chairman
Barney Brown
Supt. Water & Sewerage
Hot Springs, Ark.

Now we find ourselves in just the opposite predicament, and this report is one which might be termed "Music With Few Words." Such has come about as the result of the inability of Ye Ed to reach Fayetteville before the second day of the meeting; and, withall, something of a misunderstanding in respect to the extent to which we desired the proceedings reported for publication. In other words, our pinch-hitter only "pop-flied" this time and, in consequence, we must offer something of an apology for this report, in which the "Music" rather over-balances the few words high-lighting the Arkansan's 10th Annual Water and Sewage Conference, held at the University of Arkansas in Fayetteville, April 15th-17th.

The 1940 Conference, considered something of a milestone in Arkansas Water and Sewage development, showed progress on at least three fronts:

(1) *Record Attendance.* The 1940 meeting was the largest one on record with 120 officials and operators registered from 35 Arkansas towns and 20 out-of-state cities. Eight of this number had to their credit a perfect score of attendance at all 10 annual meetings.

(2) *Regional Meetings.* A report disclosed that 80 per cent of the 159 men attending eight Regional Schools in 1939 were superintendents and operators. Among them were representatives from 33 towns that had never sent men to any of the annual meetings held at the University.

(3) *A Licensing Plan.* Following a fruitful discussion, the Conference voted unanimously to adopt the voluntary grading and licensing plan for water and sewage work operators in the State. It set up an examining board of five members to administer the plan, which represents a composite of what the proposing Committee considered best features from licensing plans now in effect in other States. (The plan was drawn up by L. A. Jackson, Gen'l Mgr., Little Rock; Fletcher Thompson, Sup't, Clarksville, and Herbert Reiman, Office Mgr., Little Rock.)

Conference "Prime-Movers"

Prof. W. R. Spencer, Head, Dep't. Civil Engineering, and Dr. Harrison Hale, Head, Dep't. Chemical Engineering University of Arkansas, Fayetteville. (The latter having served as Secretary of the Conference since its organization 10 years ago.)

Those Who Attended the Organization Conference in 1931
Front Row: M. Z. Bair (Little Rock); Henry Nunn (Van Buren); Dr. Harrison Hale (Secy.); A. H. Ullrich (Fort Smith); D. Y. McDowell (Malvern).
Rear Row: Asie Hoskins (Eureka Spring); A. P. Jones (Houston, Tex.); E. W. Shouten (Oklahoma City); L. A. Jackson (Little Rock); Egmont Smith (Dallas); Chas. Barry (Guthrie, Okla.); H. B. Guest (Dallas); Alvin Mayhan (Little Rock); Dr. W. R. Spencer (Univ. of Arkansas).
(Note: The eight whose names are underscored have a record of having attended all of the 10 Conference meetings since organization.)

New Officers

The following officers were chosen for 1940-41:

Chairman, D. Y. McDowell, Malvern.

Vice-Chairman, Barney Brown, Hot Springs.

Professor Harrison Hale continues as Secretary, and

Professor W. R. Spencer as Chairman of the Executive Committee.

In the absence of Chairman H. S. Peck, at home in Fort Smith recovering from an automobile accident, D. Y. McDowell (then Vice-Chairman) presided over the Conference sessions.

The Technical Program

Lacking a digest of the lectures, papers and discussions the technical program is being reproduced.

1. *"Legal Responsibility of Operators"*—W. D. Hopson, Director, Ark. Municipal League.
2. *"A Study of Water Filters"*—Prof. Edw. R. Stapley, Oklahoma A. & M. College.
3. *"Our Lifetime Job"*—L. K. Covelle, Okla. Supervisor Industrial Education.
4. *"Transite Pipe"*—M. E. Duncan, Johns-Manville Corp., Tulsa.
5. *"Purpose of Chemical Tests on Water"*—R. E. Byrd, Ark. State Dept. Health.
6. *"Purpose of Bacterial Tests on Water"*—A. H. Ullrich, Ft. Smith Water Dept.
7. *"Life in Clear and Stagnant Water"*—Prof. D. Causey, Univ. of Arkansas.
8. *"Hydraulics in Connection With Water and Sewage Works"*—Marion L. Crist, Little Rock Water Dept.
9. *"Faulty Plumbing and Cross Connections"*—W. Scott Johnson, Chief Engr., Missouri Dept. of Health.
10. *"Distribution System Problems"*—A Round Table Topic.
11. *"Water Meter Maintenance"*—A Round Table Topic.

(1) E. T. Brown, City Engr. & Sup't. Water, Fayetteville, Ark.; (2) Bruce Harkness, who came down from Andover, Mass., to tell about the Tate Process of lining mains in place; (3) Marion L. Crist, Engineer, Water Department, Little Rock, Ark.; (4) J. G. Wood, Mg'r. Texarkana Water Co., (his system serves both States Texas and Arkansas); (5) Fletcher Thompson, Sup't., of Filtr., Clarksville, Ark. (served as chairman pro-tem.)

12. *"Cleaning and Cement Lining Existing Mains"*—Bruce Harkness, Tate Pipe Lining Co., Andover, Mass.
13. *"Modern Cast Iron Pipes"*—P. R. Deas, Cast Iron Pipe Co., Birmingham.
14. *"Corrosion: Its Causes, Effects and Control"*—Linn H. Enslow, Editor, "Water Works and Sewerage," New York.
15. *"Chlorination and Super-Chlorination"*—Linn H. Enslow, Engineer, The Chlorine Institute, N. Y.

(1) H. R. Power (Los Angeles) and H. H. Chaffee (Fort Smith, Ark.) representing Flexible Underground Pipe Cleaning Co.; (2) Solon Sanderson, Sup't. Water, Marianna, Ark. and E. F. Byerly, Mgr. N. E. Water & Elec. Plant, West Helena, Ark.; (3) State Sanitary Engineers F. L. McDonald (Arkansas) and Scott Johnson (Missouri); (4) R. R. Deas Jr., Engineer, Am. Cast Iron Pipe Co., Birmingham, Ala. and H. B. Guest, ACIPCO representative, Dallas; (5) A. H. Ullrich, Sup't. Filtration, Fort Smith, Ark. "Ernie" Schouten, W. & T. Co., Oklahoma City.

(1) Clifford Barton, Sup't Water, Light and Sewerage, Forest City, Ark., and Fred Sebastian, Sebastian-Diesel Co., Joplin, Mo.; (2) Jas. R. Brown, Natl. Water Main Cleaning Co., who put on an exhibition in main cleaning, and A. P. Jones, Consolidated Chemical Ind. Co., Houston, Tex.; (3) Three of Little Rock's Contingent—Alvin Mayhan, Chemist; Herbert Reiman, Office Mgr. and G. H. Sutton, Supt. Meter Dept.; (4) A. O. Chastain, Supt. Water and Sewerage, Heber Springs, Ark., and Kenneth Gilbert, Lane Co. of Arkansas, Stuttgart, Ark.; (5) F. L. Lewis, Supt. Water and Sewerage, Mena, Ark., and I. K. Leming, Supt. Water and Sewerage, Waldron, Ark.

Some of the 118 Attending the 10th Arkansas Conference.

Better a Compromise Than No Pollution Bill

Our March editorial captioned "A Debilitated Pollution Bill" has been adjudged, by those who are best qualified to speak, as stating the true picture of the situation with respect to the now emasculated Barkley Water Pollution Bill (Senate 685) which went to the House and, with an amendment added by Representative Mundt (South Dakota) and another by Representatives Keller (Illinois) and Bland (Virginia) was passed on March 1st.

We have had many comments on the editorial in question which stated—"Unless the Mundt amendment is removed or further modified it is improbable that any pollution act will come out of the present Congress." The Mundt amendment prohibits absolutely any *new* sources of pollution after passage of the act. It gives the Federal Courts power of injunction when requested by State or Federal agencies responsible for water quality.

This amendment to us was not half so lamentable a circumstance as the fact that the Barkley bill (S. 685) which had passed the Senate had shorn from it all financial aid through the grant system and all financial assistance to State agencies charged with pollution abatement before it came to the House. In fact, only $250,000 is appropriated by the bill (all the U. S. Public Health Service) and that not to become available until *after* July 1, 1941.

Two of the more interesting and significant reactions to our March editorial are here reproduced in part. One came from Hudson Biery, Chairman of the Committee on Stream Pollution of the Cincinnati Chamber of Commerce, who has been a hard and continuous worker for an adequate Federal stream pollution act, without usurping State jurisdiction in pollution correction. He has a feeling that the debilitated House bill, passed March 1st and peacefully resting in Conference Committee now for better than 3 months, gives one the impression that the fire is all but out.

The other letter comes from one who has played the part of spokesman for the Izaak Walton League of America, Inc.—Kenneth A. Reid, General Manager of the League, which has advocated nothing short of Federal jurisdiction or control over stream pollution, believing the individual States have failed in such and that State measures alone will prove inadequate without the power of Federal injunction for use as the "gentle persuader" should other procedure move too slowly.

Pertinent parts of the two letters follow:

(From Mr. Biery) "Your March editorial entitled "A Debilitated Pollution Bill" rather accurately presents the whole situation. Those well meaning but misguided sportsmen who were able to throttle the Barkley bill in 1936 and who petitioned for a veto in 1938 may not always be proud of their work.

When we look back on the Barkley bill that was killed by senatorial courtesy after passing both House and Senate in 1936, and when we look back on H. R. 2711 vetoed by the President on June 25, 1938 because of a budgetary technicality, and now analyze the "debilitated" bill which is left, one has the feeling that the fire is out. I suppose we must take the Pollyanna point of view and agree that what is left of the bill at least "makes a start," as you put it. While the Mundt amendment may represent a "compromise" in quantity, it is no compromise as to the principle of federal control versus state co-operation."

(From Mr. Reid) "I have read the editorial in your March issue entitled, "A Debilitated Pollution Bill."

Perhaps a brief review of this present pollution abatement movement in Congress would be pertinent to the comments in your editorial. This movement was started by the Izaak Walton League by the introduction of the first Lonergan bill, S. 3958, January 16, 1936. . . . The forerunner of the present Barkley bill made its appearance in Congress some two months later along with four or five of a similar nature which provided only for study and investigation by public spending, but *no control*.

Considering this fact and the further fact that it was actively supported by commercial and industrial organizations and the individual manufacturing groups of these organizations which contributed in a major way to our present industrial pollution problem, we had reason to believe that it was, in fact, a flank attack—a bill to *prevent control of pollution*, not one to control pollution.

Two years ago the League demonstrated its willingness to cooperate by dropping its own bill in return for the inclusion of certain so-called Lonergan amendments in the then Barkley bill. The League then supported the amended Barkley bill and only when in the closing days of Congress all of these amendments were ripped out did the league withdraw this support and oppose it. Fortunately for the cause of clean streams, the President vetoed it. . . .

On March 1 of this year the League again demonstrated its willingness to co-operate and that it had no pride of authorship, but was interested only in accomplishment of the objective. On acceptance of the Mundt amendment by the House, we again dropped our own bill, the Mundt bill H. R. 7971, and supported the Barkley bill. In all fairness, it is now up to those who have been giving lip service to the cause of pollution abatement through support of the Barkley bill, to continue their support of the amended bill, or admit that they have been insincere all the time. . . . The amended Barkey bill is indeed a middle-of-the-road bill. It puts no compulsion whatever on existing pollution. The advocates of study have their Barkley bill which they have long eulogized. Neither in it nor the Mundt amendment is there the slightest compulsion for the correction of any existing pollution. The Mundt amendment simply draws a line at the edge of existing pollution and says pollution shall not cross that line.

Those people who profess to seek abatement of pollution, and who at the same time object to a simple provision that would ban its increase are in an untenable position.

Certainly if we are not willing to stop the spread of pollution to new sources we cannot hope to accomplish anything worth while in correction of existing pollution. Opposition to the very mild Mundt amendment can only be construed as approval for unrestrained spread of pollution."

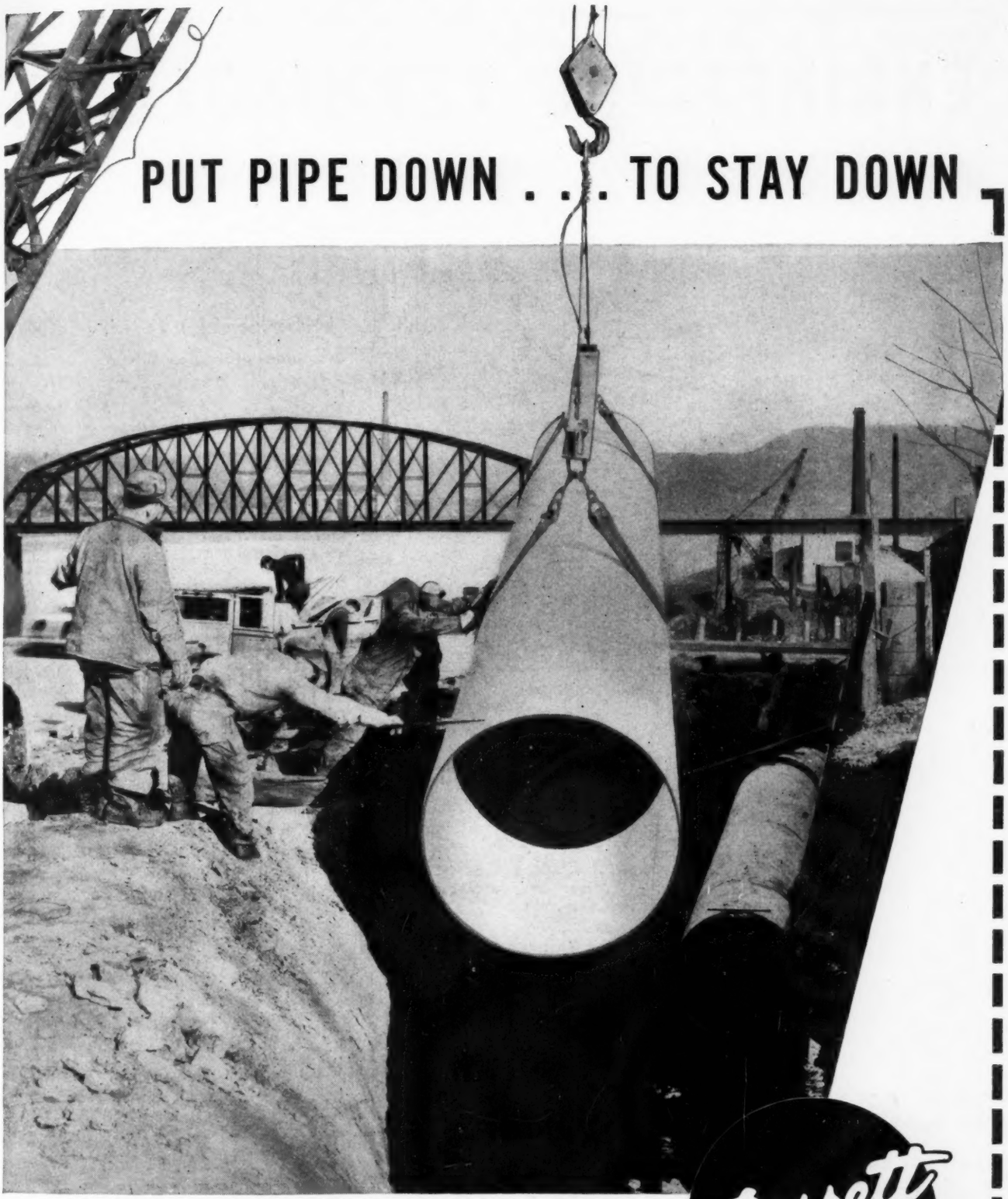
One is forced to agree that the Mundt amendment constitutes a relatively mild form of legislation as compared to earlier bills drafted to meet ideas of the sportsman's organizations and supported by these groups, which in turn worked to defeat the cooperative type of bills that would in all likelihood have long since been law.

We feel sure that the true advocates of a workable National stream pollution law will accept the Mundt amendment rather than see the present bill go the way of earlier ones. The Mundt amendment, directed at preventing *new* pollution but giving no Federal jurisdiction over existing pollution (industrial or municipal), is seemingly not such an untenable compromise to make with those who have to date defeated the purpose of both groups by fighting a losing battle for too drastic legislation. It is our hopes, and that of many, that the Conference Committee will be successful in securing an agreement between the "Federalists" and "State's Righters" and that even the "half-loaf" revised Senate Bill 685 will prove the starter which gets us under way on a much needed National program of pollution abatement of equal force in every State.

Those who feel inclined to express an opinion on the bill, now in conference, can secure the essentials by reading the editorial in our March issue. Such comments can be sent through us or presented direct to Representative Mansfield, Chairman of the House Conference Committee, in whose hands the bill now rests.

L. H. Enslow

PUT PIPE DOWN . . . TO STAY DOWN



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DESIGNED in conformity with the new A.S.A. Law and precision-manufactured by the Mono-Cast Centrifugal Process in sand-lined refractory molds, Mono-Cast Centrifugal Pipe possess unusually high physical strength properties in addition to the well-known inherent resistance to corrosion which is characteristic of all Cast Iron Pipe. Furnished Enamelined at no extra cost. Available with B&S, Doublex Simplex, or other special joints. Complete line of fittings in all sizes. Write for literature.

AMERICAN CAST IRON PIPE CO.
BIRMINGHAM, ALA.

NEW YORK CITY CHICAGO KANSAS CITY MINNEAPOLIS
DALLAS LOS ANGELES SAN FRANCISCO PITTSBURGH
CLEVELAND

LOWER COST SEWAGE PLANTS

Now available through the use of Low Rate-High Capacity Trickling Filters.

Use Aero-filters for economy.

Over forty installations in more than fifteen States.

Write for information.

LAKESIDE ENGINEERING CORP.
222 WEST ADAMS STREET CHICAGO

MEETINGS SCHEDULED

June 20-22—Syracuse, N. Y. (Hotel Syracuse)
New York State Sewage Works Association. Sec.-Treas., A. S. Bedell, State Dept. of Health, Albany, N. Y.

June 21—Wildwood, N. J.
South Jersey Association of Water Superintendents. Sec'y., Walter Spencer, 2707 Bethel Ave., Merchantville, N. J.

June 24-28—Atlantic City, N. J. (Chalfonte-Haddon Hall)
American Society of Testing Materials (Annual Meeting). Sec.-Treas., C. L. Warwick, 260 So. Broad St., Philadelphia, Pa.

June 24-26—State College, Pa. (Nittany Lion Inn & Dormitories)
Pennsylvania Water Works Operators' Association. Annual Convention. Sec.-Treas., I. M. Glace, Consulting Engineer, 22 So. 22nd St., Harrisburg, Pa.

June 26-28—State College, Pa. (Nittany Lion Inn & Dormitories)
Pennsylvania Sewage Works Association. Sec.-Treas., L. D. Matter, Distr. Engr., Kirby Health Center, Wilkes Barre, Pa.

Aug. 14—Boothbay Harbor, Maine
Maine Water Utilities Association. Sec.-Treas., Earle A. Tarr, Winthrop, Me. (Future Meetings Scheduled—Oct. 9—Millinocket; Dec. 12—Mexico).

Sept.—Wahpeton, North Dakota
North Dakota Water & Sewage Works Conference. Sec'y.-Treas., Lloyd K. Clark, State Dep't. of Health, Bismarck, N. D.

Sept. 11-13—Ann Arbor, Mich. (Univ. of Michigan Union)
Michigan Conference on Water Purification. Sec.-Treas., R. J. Faust, Michigan Dept. Health, Saginaw, Mich.
(Meeting Jointly with)
Michigan Section A.W.W.A. Sec.-Treas., M. N. Gerardy, 803 Water Board Bldg., Detroit, Mich.

Sept. 16-17—Denver, Colo. (Cosmopolitan Hotel)
Rocky Mountain Section A. W. W. A. Secretary, R. V. Howe, State Office Bldg., Denver, Colo.

Sept. 18-20—New Castle, Pa. (Castleton Hotel)
Western Pennsylvania Section A.W.W.A. Sec.-Treas., E. P. Johnson, 418 Flannery Bldg., Pittsburgh, Pa.

Sept. 24-27—New York, N. Y. (Commodore Hotel)
New England Water Works Association. (59th Annual Convention). Secretary, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Sept. 30-Oct. 2—Detroit, Mich. (Book-Cadillac Hotel)
American Public Works Association. Exec. Director, Frank W. Herring, 1313 E. 60th St., Chicago, Ill.

Oct. 1-2—Columbus, Ohio (Neil House)
Ohio Conference on Sewage Treatment. Sec'y., B. M. McDill, State Department of Health, Columbus, Ohio.

Oct. 3-4—Columbus, Ohio (Neil House)
Ohio Conference on Water Purification. Sec'y., T. R. Lathrop, State Dep't. of Health, Columbus, Ohio.

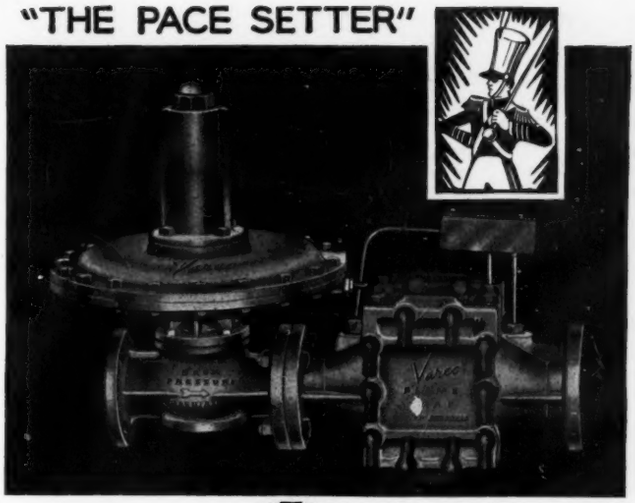
Oct. 3-5—Chicago, Ill. (Hotel Sherman)
First Annual Convention
Federation of Sewage Works Associations
Sponsored by
Central States Sewage Works Association
Gen'l Chairman, George J. Schroepfer, Box 3598, St. Paul, Minn. Local Chairman, Dr. F. W. Mohlman, San. Distr. of Chicago, 910 So. Michigan Blvd., Chicago. Sec'y.-Treas. Central States Ass'n., W. H. Wisely, Ill. State Dept. of Health, Springfield, Ill.

Oct. 8-11—Detroit, Mich. (Book Cadillac Hotel)
American Public Health Association. Exec. Sec'y., Dr. Reginald M. Atwater, 50 West 50th St., New York City.

Oct. 10-11—Glens Falls, N. Y.
New York Section A.W.W.A. Sec'y.-Treas., R. K. Blanchard, 50 West 50th St., New York City.

Oct. 14-17—Tulsa, Okla. (Mayo Hotel)
Southwest Section A.W.W.A. Secretary, Lewis A. Quigley, 3320 W. Berry Street, Fort Worth, Texas.

"THE PACE SETTER"



"Varec" Approved Pressure Relief and Flame Trap Assembly.

"Varec"
SEWAGE GAS CONTROL & SAFETY DEVICES

OUR AIM is to do things well; to produce devices that are superior in accuracy, sensitivity and reliability. Progressive engineering, good design, first-class workmanship and materials, together with rigid inspection and testing, insure the quality of "Varec" Products.

"VAREC" *Approved* PRODUCTS

PRESSURE RELIEF AND FLAME TRAP ASSEMBLY • FLAME TRAP ASSEMBLY • PRESSURE RELIEF AND VACUUM BREAKER VALVES • FLAME ARRESTERS • WASTE GAS BURNERS • FLAME CHECKS • BACK PRESSURE REGULATORS • PRESSURE (REDUCING) REGULATORS • CHECK VALVES (NON-CHATTERING) • SEDIMENT TRAPS • DRIP TRAPS • MANOMETERS • PRESSURE (EXPLOSION) RELIEF VALVES • MANHOLE COVERS • HANDHOLE COVERS • SAMPLING HATCHES

Over 300 Sewage Treatment Plants have been equipped with "Varec" Equipment in less than two years.

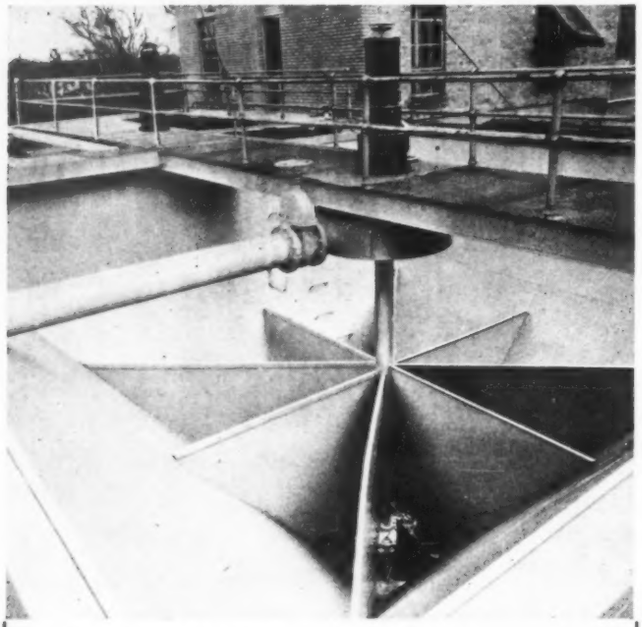
The VAPOR RECOVERY SYSTEMS COMPANY
2820 No. Alameda Street
Compton, California

NOW
Send for Our New 1940 Catalog

Permutit
Spaulding Precipitator

increases capacity of water softening plant for Illinois City*

** Name on request*



View showing how existing concrete settling basins were converted into Spaulding Precipitators. Capacity increased to 3 million gallons per day.

New Design Cold Lime Treatment Solves Increased Demand

Since this progressive city has been softening its water supply, many new users have signed up. Among them was a large industry needing a maximum of one million gallons a day. But where to find the extra capacity necessary to handle this increased load?

The problem was solved by converting the existing concrete settling basins into Spaulding Precipitators, which, because of their shorter settling period substantially increased the capacity of the plant. The ease with which the Precipitator was adapted to fit these oblong basins demonstrates the flexibility of the basic design.

Have you an unusual water conditioning problem? Let the world's largest makers of water conditioning equipment lend a hand. Permutit's coast-to-coast staff of field engineers is glad to co-operate with architects, engineers and municipal officials. For free booklets address The Permutit Company, Dept. G1, 330 West 42nd St., New York.

PERMUTIT **WATER CONDITIONING HEADQUARTERS**

Oct. 14-16—MANITOWOC, WISC. (Hotel Manitowoc)
Wisconsin Section A.W.W.A. Sec'y.-Treas., L. A. Smith, City Hall, Madison, Wisc.

Oct. 16-17—SPRINGFIELD, MASS. (Hotel Kimball)
New England Sewage Works Association. Sec'y.-Treas., LeRoy W. VanKleeck, State Dep t. of Health, Hartford, Conn.

Oct. 16-18—ATLANTIC CITY, N. Y. (Haddon Hall)
Pennsylvania Water Works Association. (45th Annual Meeting.) Secretary, F. Herbert Snow, 507 Telegraph Bldg., Harrisburg, Pa.

Oct. 18-19—ATLANTIC CITY, N. J. (Madison Hotel)
New Jersey Section A.W.W.A. Sec.-Treas., C. B. Tygert, Box 178, Newark, N. J.

Oct. 21-23—LEXINGTON, KENTUCKY (Hotel Lafayette)
Kentucky-Tennessee Section A.W.W.A. Sec.-Treas., H. D. Schmidt, State Dept. of Health, Nashville, Tenn.

Oct. 23-26—LOS ANGELES, CALIF. (Los Angeles-Biltmore Hotel)
California Section A.W.W.A. Secretary, Burton S. Grant, 207 So. Broadway, Los Angeles, Calif.

Oct. 24-25—HUNTINGTON, W. VA.
West Virginia Section A.W.W.A. Sec'y.-Treas., J. B. Harrington, Dep't. of Health, Charleston, W. Va.

Oct. 28-30—RALEIGH, N. C. (Sir Walter Raleigh Hotel)
North Carolina Section A.W.W.A. Sec'y.-Treas., R. S. Phillips, 319 E. Trinity Ave., Durham, N. C.

(Meeting jointly with)

North Carolina Sewage Works Association. Sec'y., M. F. Trice, State Board of Health, Raleigh, N. C.

Nov. 7-8—ST. PAUL, MINN. (Hotel St. Paul)
Minnesota Section A.W.W.A. Sec.-Treas., R. M. Finch, W. & T. Co., 416 Flour Exchange, Minneapolis, Minn.

Nov. 7-8—WILMINGTON, DEL. (Hotel Du Pont)
Four States Section A.W.W.A. Sec'y.-Treas., Carl A. Hechmer, Washington Suburban Sanitary Dist., Hyattsville, Md.

Nov. 13-15—OMAHA, NEB. (Fontenelle Hotel)
Missouri Valley Section, A.W.W.A. Sec'y.-Treas., E. L. Waterman, Univ. of Iowa, Iowa City, Ia.

LITERATURE AND CATALOGS

"Limitorque Automatic Valve Controls" are the subject of a very attractively produced and comprehensive catalog of 66 pages from Philadelphia Gear Works, long established manufacturers of gears, speed reducers and valve controls. Defining the term "Limitorque," it has the full meaning, in that the Torque-Limit Switch on the circuit to the motor driven valve gears prevents possible damage to the valve parts or mechanism by automatically limiting the torque developed in opening or closing of valves, whether by remote control, automatic control or manual push button operation. The new catalog presents a full technical discussion and presents design data and facts concerning "Limitorque" Controls for valves from 3 inches to 96 inches in diameter, with their effectiveness and safety features for remote control of valves and other mechanisms. The illustrations picture a great variety of installations on water and sewage systems and treatment plants, with the control unit connected to many types and makes of valves and large gates. For a copy of "Limitorque Control" write Philadelphia Gear Works, Philadelphia, Pa.

"Incinerators — by Nichols" — is what one might term the recent presentation of the "complete line" of Nichols refuse, garbage, screenings, and sludge incinerators. It discusses the character, composition and quantity of municipal refuse, and contains a table of typical average production month by month in pounds per capita. In respect to furnaces for burning these solid wastes the 30 page brochure (with "Wire-O-Binding" to permit adding of pages) outlines the especial features and per-

formance characteristics of the improved Nichols Basket Grate Furnace, developed from the well known Decarie design which allows heavy and sporadic loadings without smothering the fired material. The basket consists of water cooled pipes exposing the drying material to heat on 5 sides. Next appears the Hiler multiple-cell type Nichols Continuous Grate Furnaces which is the most simple design and advantageous for uniformly charged burning, with or without steam generation as the byproduct. Easy stoking and manipulation of counter-weighted grates and doors, as well as flexibility, are features of this type. The third type presented is the now well established but youngest of the lot—the Herreshoff type Nichols Multiple Hearth Furnace—for burning sludge cake, or screenings and grit on rabbled circular flat hearts. Also presented is the Nichols Refratory Preheater, for maximum thermal economy in all forms of incineration. At the last is a section devoted to pictures of representative incineration plants and a listing of cities showing types and capacities of incinerators in service. For a copy of "Nichols Incinerators," write Nichols Engineering and Research Corp., 60 Wall Tower, New York City.

"Graver Sub-Surface Filtration Systems" are described and illustrated in a new bulletin from Graver Tank and Mfg. Co. of Chicago, The Graver System makes use of the lantern shaped (conical) filter screens patented by Ira H. Jewell, who has long been identified with water filtration developments. The basic claim for the system is an increase in filter capacity which results when equipping sand filters with the system. Furthermore, in sand bed washing the system serves to produce a "top-wash" of the bed and is claimed to result in wash water economy and assured freedom from mud-balls and other bed troubles. In the process of filtering, a 50% increase in filtering rate (namely 3 gals./sq. ft./min.) is obtainable with the same loss of head. In such increase it is stated that the quality of effluent is not adversely affected and economy results. For a copy of "Sub-Surface Filtration Systems," write Graver Tank and Mfg. Co., East Chicago, Indiana.

[*Because of the erroneous address in the above item, which appeared last month, it is being re-run.*]

"Saunders' Patent Valves—by Hills-McCanna" are once more splendidly described and illustrated in a new Hills-McCanna Co. catalog depicting 12 features and outstanding advantages as valves for highly corrosive or abrasive fluids—either for shut off or throttling flow. The Saunders' Patent Valve is the pinch-type diaphragm valve which has had a highly successful service record of low cost maintenance and trouble free operation in the chemical industry, and in latter years in water purification and sewage treatment plants. These valves come with threaded connections in sizes ½ to 3 inches; with bolted flange connections from ½ to 14 inches. Full specifications and detailed drawings are supplemented by pictures of installed units in many industrial and municipal plants, where used on lines conveying ferric chloride, chlorine water, and alum solutions. Also briefly covered are Hills-McCanna's Chemical Proportioning Pumps, Centrifugals for Corrosive Liquids, Oil Lubricating Systems. For a copy of Catalog V-40 write Hills-McCanna Co., 2349 Nelson St., Chicago.

"Steel Valves and Fittings—by Crane" are illustrated and described in a new catalog presenting what is believed to be the most complete line of steel valves and fittings in the world. In addition this book of 306 pages is devoted to kindred steel specialties and accessories, and, in addition, contains engineering data pertaining to high pressure-temperature piping problems. An ingenious method of indexing this catalog makes it easy to turn immediately to the section wanted, and it

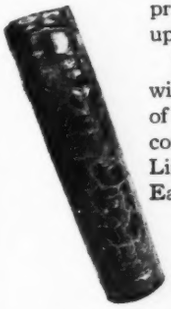
FOR EFFECTIVE PIPE PROTECTION

COATINGS must be WRAPPED with ASBESTOS FELTS

● Here's a money-saving tip to waterworks engineers. More than 25 years' experience in the oil and gas industries has proved many types of ferrous pipes must be protected by a corrosion-resistant coating. What's more, the coating must be reinforced or shielded with a strong, durable wrapping to prevent distortion and abrasion. And, for that service, asbestos—in the form of J-M Pipe-Line Felts—has proved the ideal material.

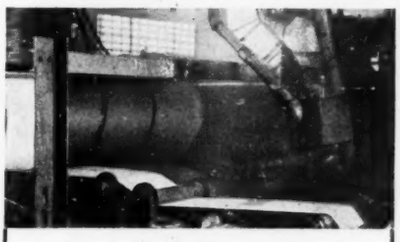
Because the asbestos fibers are inorganic and non-tubular, J-M Asbestos Felt cannot support capillary action. Tough and durable, it reinforces the coating against earth load and soil stress. And, because it is exceptionally resistant to the corrosive action of soil acids and alkalis, this durable felt gives efficient protection for the coating . . . helps keep upkeep costs to a minimum.

You'll be interested in the whole story. It will show you why more than 30,000 miles of pipe are operating at low cost under severe conditions. Write for the J-M Asbestos Pipe-Line Felt brochure to Johns-Manville, 22 East 40th Street, New York, N. Y.



UNWRAPPED BITUMINOUS COATING after exposure to clay-content soil. Soil stress has destroyed much of the protective coating.

THE SAME COATING, under the same conditions, but wrapped with J-M Asbestos Felt. The wrapping shows no signs of breakdown . . . the coating underneath is practically as good as new.



YOU CAN PURCHASE pipe from the steel-pipe mill coated with any standard coating material and wrapped with Johns-Manville Asbestos Felts. Or the same operation can be performed in your own yard by portable wrapping equipment supplied on a rental basis. Write Johns-Manville, 22 East 40th Street, New York, N. Y., for further information.

JOHNS-MANVILLE JM ASBESTOS PIPE-LINE FELTS

···But a new trend toward better sanitation standards, in which Solvay Liquid Chlorine plays an important role, is fast solving sewage disposal problems

Strange to say, "the old swimmin' hole" is becoming a new national problem—a problem in sanitation brought about by the disposing of sewage and industrial wastes in streams feeding into rivers and bays.

As a solution to this problem, many communities have already built sewage disposal plants. Some of these plants utilize chlorination as a step in the process of sewage disposal, which automatically controls bacteria load. Other plants, however, chlorinate only during summer months. Still others rely on methods which simply precipitate solids, permitting contaminated effluent to flow off into rivers and streams.

The danger zone is downstream. But the danger zone becomes a safety zone when Solvay Liquid Chlorine is used to make doubly certain that *all* effluent is *completely* purified before it is sent from the plant.

Many of America's largest municipalities and leading manufacturers have long used Solvay Liquid Chlorine. They are constant users because of the outstandingly high quality symbolized by the Solvay Anchor Trademark . . . and because of service facilities Solvay is in a position to provide. These include sound technical advice by men who are fully conversant with the day-to-day problems of sanitation and water supply. There is also the important fact that Solvay is in a position to supply sudden demands for liquid chlorine in times of emergency. Your inquiries are cordially solicited.

Member American Water Works Assn.

SOLVAY SALES CORPORATION

Alkalies and Chemical Products Manufactured by The Solvay Process Company

40 RECTOR STREET · · NEW YORK, N. Y.

SOLVAY

TRADE MARK REG. U. S. PAT. OFF.

LIQUID CHLORINE

should be a valuable asset to engineers, piping contractors, purchasing agents, and others. Designated as Catalog 40-S a copy may be had from Crane Co., 836 S. Michigan Ave., Chicago, Ill.

"Hayward Catch-Basin Buckets" which are products of the Hayward Co. of New York, manufacturers of several types of material handling buckets, are the subject of a new bulletin effectively illustrating the features of these husky little orange-peel type buckets and picturing the unit at work. They are designed for operation with a double-drum power hoist of any type. Tables show dimensions and weights of the 13, 15 and 18 inch buckets, especially designed for catch basin work and use through pit, tank or sewer manholes or in cramped quarters generally. We are safe in saying that no city which has ever used this or a similar power bucket in sewer maintenance work will ever be without them. For a copy of Bulletin 805 write The Hayward Co., 50 Church St., New York City.

"Water Meter Protection — Some Fundamentals" cites eleven major causes of frost troubles with water meters, and presents six essential features of frost-protection in meter-box design. Sketches are employed to illustrate good, bad, and "indifferent" meter settings, and proper design and dimensions of the box. This brochure of hints in water meter protection may be had by request to the H. W. Clark Co., Mattoon, Illinois.

"Turn Sludge Into Profits" is the theme of a bulletin issued by the manufacturers of the well known Royer Sludge Disintegrators. Presenting suggestions as how best to prepare and market dried sewage sludge, the bulletin tells what the Royer is, what it does, and what it returns through sales of shredded sludge. Pictured are models for every community pocket book—from the small Junior model up—a dozen 1940 models in all, with specifications covering each. This informative bulletin No. 140 may be had from Royer Foundry and Machine Co., Kingston, Pa.

"Worthington Air Compressors" are covered in a bulletin and an accompanying leaflet. The first is devoted to small twin V-cylinder compressors featuring the quiet and efficient feather-valve arrangement and the intercooler. Units pictured have specifications given. The leaflet is devoted to the new Worthington Portable (rubber tired) compressors which incorporate the balanced twin V-cylinder units covered in the bulletin and a Hercules 6 cylinder engine. Streamlined, this portable is designed for appearance as well as ruggedness. For "Worthington Portable Air Compressors" write Worthington Pump and Machinery Corp., Harrison, N. J.

"G.E. Sump Pump Motors" are termed "packaged units" ready to assemble on your pump. These improved units feature a built-in float switch and automatic reset thermal-overload protection, for dependable operation in continuous dampness. The feature of the float-switch is the spring counter-balance of the rod weight and corrosion proof parts with fine-silver contact tips. The bulletin number is GEA-3352—the address: General Electric Co., Schenectady, N. Y.

"Selectrol Bulletin No. 3" is the third of a series of completely revised and amplified bulletins covering Automatic Control Co.'s equipment. The revised bulletin contains more information on pump control problems and how to choose the type of control equipment needed for sequence or program control of pump operations. It describes and pictures the several "Selectrols" available and lists prices of each, and also of accessories. Explosion Proof Selectrols are apparently a new addition. Everyone who has the old Bulletin S-5 should replace it with the revised S-6. For a copy write Automatic Control Co., 1005 University Ave., St. Paul, Minn.

"Shatter-Proof"

STEEL PIPE

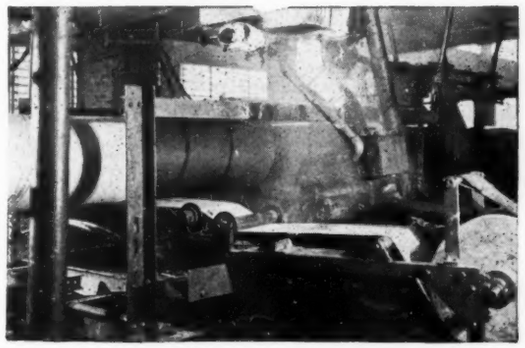
assures

HIGH FLOW CAPACITY

and is insurance

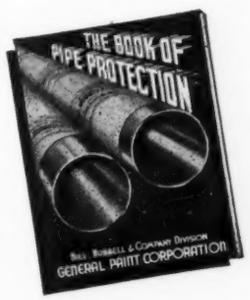
AGAINST BREAKAGE

STEEL PIPE Lined with BITURINE AKWALINE Enamel by the HILL-HUBBELL "factory process" has a "C" factor 12% greater than new cast iron pipe. This assures high flow capacity and PERMANENT low pumping costs. "Shatter-proof" STEEL MAINS reduce breakage to the minimum.



With the HILL-HUBBELL Process all Lining and Coating-and-Wrapping is done MECHANICALLY—INDOORS. Illustration shows how Coating-and-Wrapping is applied in ONE operation.

GET YOUR COPY



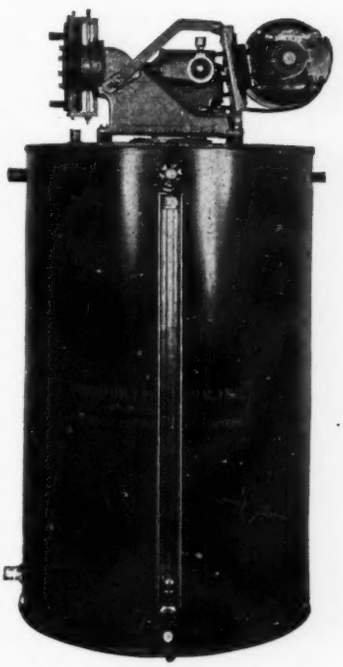
The Book of PIPE PROTECTION describes in detail how STEEL PIPE is MECHANICALLY Lined and Coated-and-Wrapped at the Mills under ideal conditions. Use your letterhead and write for a copy.

GENERAL PAINT CORPORATION
HILL, HUBBELL & CO. · Division · Cleveland, Ohio
· EXPORT OFFICE SAN FRANCISCO, CALIFORNIA, U. S. A. ·

Following %Proportioneers% usual policy of reducing chemical feeding to its simplest, most efficient terms we present to you—

THE PACKAGED AMM-O-FEEDER

This unit consists of complete ammoniation equipment for water plants using up to 30 lbs. of NH_3 per day at approximately one-half the cost of gas equipment. The cost of chemical, in most cases, is also cut in half!



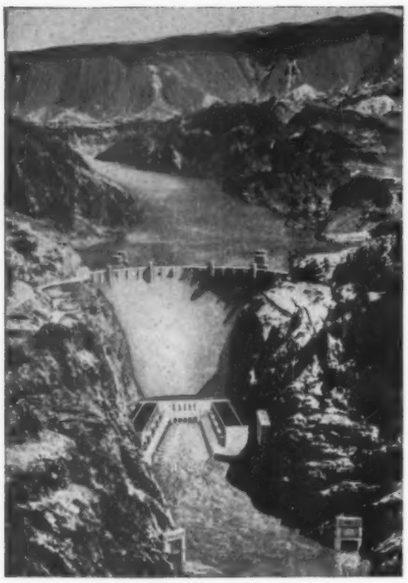
The new "Packaged" AMM-O-FEEDER

Fume-proof, simple, accurate, dependable; Amm-O-Feeder is proving to be one of our outstanding contributions to water treatment. *It takes the complications out of ammoniation* and places it within the reach of any plant — no matter how small — at the same time it is the most economical and efficient method for almost any plant ranging in size from Norway, Maine, with a population of 2500 to Washington, D. C., with a population of ½ a million.

For swimming pools, the package unit is especially recommended as safe in the hands of non-technical operators.

Write, giving your rate of flow and ammonia dosage. We shall be glad to give you full information and prices or have a sales engineer call—with no obligation on your part.

% PROPORTIONEERS Inc. %
9 NO. CODDING STREET PROVIDENCE, R. I.



Bailey Meters AT

BOULDER DAM

● In Boulder Dam Power Plant as in many other new hydro-electric stations including Madden Dam and Norris Dam, Bailey Fluid Meters are installed on hydraulic turbines.

At Boulder Canyon, the Bailey Meters measure water supply through 13 foot diameter penstocks under an average head of 530 feet. These meters indicate and record the water flow in terms of cubic feet per second and continuously integrate in millions of cubic feet. The registers are operated by pressure connections in the turbine scroll casings.

While your project probably does not entail the volume and head of water that is being measured at Boulder Canyon, it is nevertheless, important that your measurements of flow and liquid level be accurately made by reliable equipment.

Write for complete information on the application of Bailey Meters to your problem. MU-19

BAILEY METER • COMPANY •

1072 Ivanhoe Road, Cleveland, Ohio

BAILEY METER COMPANY LTD., MONTREAL

EQUIPMENT NEWS

A New Rapid Filter by Laughlin

● W. C. Laughlin, inventor of the original Laughlin Magnetite Filter has recently announced a vastly improved shallow type Rapid Filter.

The unit here sketched was exhibited for the first time at the meeting of the New Jersey Sewage Works Association. It has many novel and unique features, and functions solely as a down flow unit. It is to be noted that the new filter is designed with a greater bed depth for more effective clarification and has a bed patterned after that of orthodox rapid water filters. A layer of magnetite sand is provided to preclude gravel lifting and/or sand penetration from the fine sand layer above. The wash-water feature is even more interesting. The new Laughlin Filter is designed as a bed of multiple filter cells, each being subject to individual wash as the wash water applicator travels progressively from port to port to produce bed liquefaction and positive cleansing.

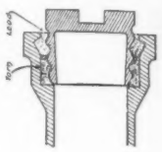
Washing economy is provided by the travelling Surface Cleaner which agitates and flushes the dirt from the surface only until such time as the head loss requires the bottom wash to go into operation. Thereby the minimum of total wash water and power is consumed in maintaining a clean bed.

These improved units are being offered for industrial and municipal water supply, swimming pools, sewage and trade waste treatment and water recovery from industrial wastes.

A brochure "A 1940 Modification of the Rapid Sand Filter" effectively describes the unit and its operating features. For a copy, write Laughlin Equipment Corp., 270 Madison Ave., New York.

Rapp's Removable Plugs

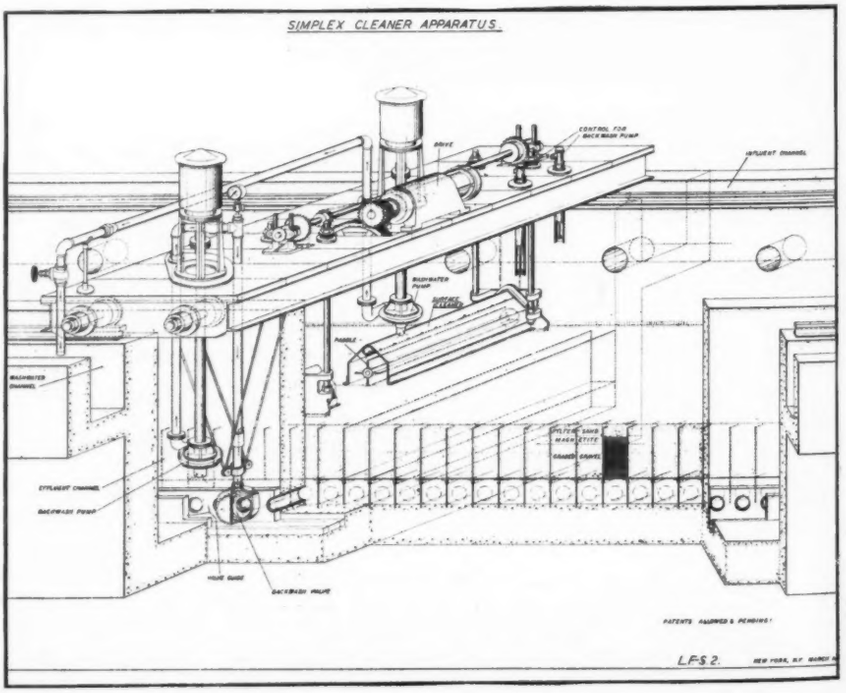
● Rapp's Removable Screw Plugs are really not new, since they have been used for many years on the Atlanta system and elsewhere. However, we have seen little or no mention of these money and time saving plugs in the literature and this announcement will be news to most of our readers.



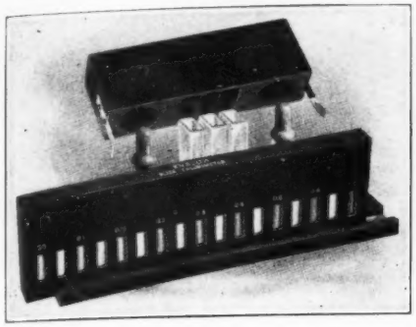
These salvable, money and time, and tool saving plugs for closing pipe ends and fittings are the invention of "Bill" (W. M.) Rapp, Sup't. of Distribution at Atlanta. These plugs are also available with a threaded opening for 1, 1½ or 2 inch pipe, for running extensions or temporary supply lines.

In using these Removable Screw Plugs the plug is placed in the bell and yarned in, then pour the lead and caulk in the usual manner. To remove the plug, it is first loosened with a striking hammer and then, by placing a crow-bar or pick-end between any two of the four lugs, it is backed out a turn; then the rest of the way by hand. To replace, just screw in and tap up the joint with the caulking iron. Note the double lock formed by the lead seal—see cut. Says Mr. Rapp—"Ask the man who has used one"—especially if he has had experience breaking out old style plugs before.

For descriptive folder giving more details and prices, write W. M. Rapp, P. O. Box 584, Atlanta, Ga.



Improved Slide Chlorimeters Taylor-Enslow Chlorimeter

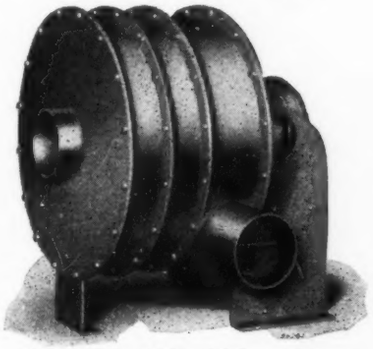


• W. A. Taylor and Co. of Baltimore have improved their slide-type pH and residual chlorine test sets by redesign and use of a moulded plastic in producing the slides containing the standard color tubes and also the block containing test-cells and reagents. The color standards can not rattle and are guaranteed against fading indefinitely.

In a new folder is pictured the trim new design of the Taylor-Enslow Slide Chlorimeter, and the Combination Set with its dual use in swimming pool control for measuring pH value as well as residual chlorine.

For a copy write W. A. Taylor & Co., Inc., 872 Linden Ave., Baltimore, Md.

New Motor Blower



An Ingersoll-Rand Three-Stage Type "G' Motorblower

• A new "Motorblower" featuring reliability, quiet operation and low cost, has just been announced by Ingersoll-Rand.

In addition to reliability and quietness, the manufacturer claims numerous features which make the Type "G" Motorblower ideally suited to furnishing air for general uses. The unit can be installed on any floor, since it requires no special foundation.

The maintenance of constant pressure over the entire volume range is stressed as being particularly advantageous. The blower characteristics are such that power consumption varies approximately in proportion to the volume of air delivered. Type "G" Motorblowers are built in 72 sizes: pressures from ½ to 2¼ lbs. and volumes from 100 to 4500 c.f.m. are available.

Additional information is contained in Form 2671, available from Ingersoll-Rand Co., 11 Broadway, New York City.

Utilization of its resources is America's heritage. No nation has made better use of its natural wealth, for the common good. Progressive cities everywhere are successfully using Royers to convert sewage sludge into useful fertilizer—turning a loss into a profit.

BARK USED TO BE A PROBLEM AT SAWMILLS!

Sawmills used to have to pay laborers good money to burn the bark trimmed from logs in making lumber —now they use it for wallboard, compress it for fuel and use it for scores of other by-products.

Similarly, many cities still incinerate, bury or dump their sewage sludge—other cities have not only eliminated these disposal costs but have realized worthwhile profits by converting the sewage sludge into readily marketed fertilizer with a Royer Sewage Sludge Disintegrator.

Royers shred, mix and aerate sludge, further drying it and reducing it to small particles that are readily assimilated by the soil. They handle sludge with a moisture content as high as 51%, and remove sticks, stones and trash. Lime, ammonium sulphate and other enrichening materials are readily mixed in. The Royer discharges into trucks or wagons, or onto a stock pile.

Sewage sludge contains elements essential to plant growth and finds a ready market among growers, golf clubs, cemeteries and municipal parks when properly prepared with a Royer.

Send for bulletin showing the 12 Royer Models from $250.00 up for every requirement and giving further facts on the properties and marketability of Royer Disintegrated Sewage Sludge.

Reading, Pa., readily converts sewage sludge into an ideal fertilizer with a Royer.

THE ROYER

ROYER FOUNDRY & MACHINE COMPANY

170 Pringle St. Kingston, Pa.

SPEEDS

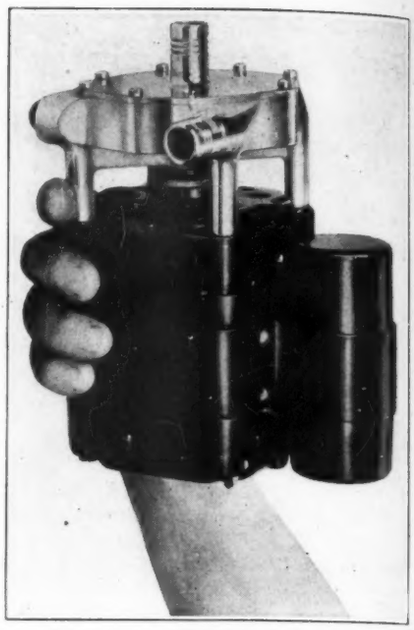
WORK IN BELL AND SPIGOT JOINTING

Save days, waiting for that initial joint leakage to heal, by using Tegul-MINERALEAD ● With this sulfur-base compound those leaks heal **quickly.** You can go right ahead with back filling and clearing up ● Your men can swing those 10 lb. Ingots easily — and store them on the job without fear of rain or flood ● Melting pot is easily replenished without delaying work—and the Ingot form dismisses all danger of composition changes in transit ● Tegul-MINERALEAD makes tough, tight joints that smile at vibration, thermal and mechanical shock ● No other jointing compound is like this. Write The ATLAS MINERAL Products Company of Pa., Mertztown, Pa.

A Tegul PRODUCT

Tegul-MINERALEAD

New Midget Centrifugal Pump

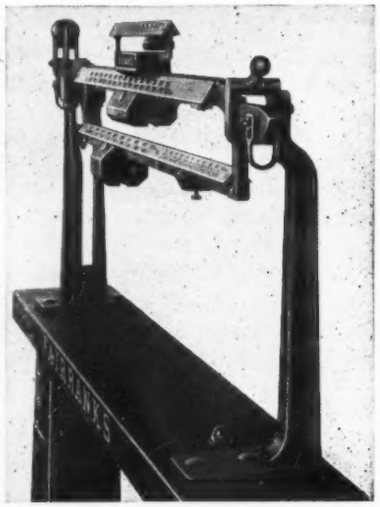


● The Eastern Engineering Co. of New Haven, Conn., have developed what is thought to be a unique small centrifugal, cataloged as Eastern Model D. Midget Centrifugal. Its compactness is illustrated in the picture—(7¾" x 6⅜" x 5⅛"). It weighs 14 pounds.

This little pump can be used in numerous small scale pumping or recirculation operations, with safety—because its motor is spark proof. The motor armature and impeller are mounted on a continuous shaft. It produces a maximum head of 17 lbs. and delivers a maximum volume of 5 gals. min.

The pump proper is obtainable in any of the better known corrosion proof alloys, including Monel metal and Hastelloy. It is not one of the low priced midget pumps, but is built for sustained dependable service and is reasonably priced. For descriptive literature write Eastern Engineering Co., 45 Fox St., New Haven, Conn.

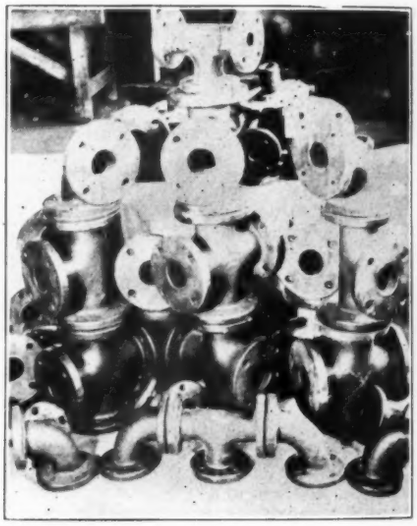
Fairbanks Improved Beam Scales Make for Reading Ease and Accuracy



● The full capacity beam announced by Fairbanks-Morse makes accurate weighing much faster and easier.

Taking a leaf from the experience of radio manufacturers, all graduated face plates are set at an angle of 45 degrees, to eliminate "hunchback" weighing. These plates are made of aluminum, their large black etched-in figures are very easy to read. For further details concerning this and other recent improvements in scale design request Publication ASB 610.4. Address "F.M." Co., 600 South Michigan Ave., Chicago.

Rubber Insulated Pipe and Fittings



● Here pictured are examples of rubber-insulated fittings that have been protected by the "S.R.L." method of application of rubber to metal.

All units, up to one-foot long, are given complete insulation—in and out—including flanges and bolt-holes. Long lengths, including pipes, are given application of Paramount Rubber Paint to exterior surfaces back of the flanges.

The rubber coating is built up on the specially treated metal surfaces to the required thickness, with complete absence of seams and laps. Flange couplings are made flexible by the covering, and bolt "freezing" is an impossibility.

For further details concerning "S.R.L." (Seamless-Rubber-Lined) fittings, pipe or vats, address Paramount Rubber Service, Inc., 1430 Rosedale Court, Detroit, Mich.

HYDRO-TITE

ONE POUND does the work of four pounds of lead. Much easier to use than lead and requires no caulking.

HYDRO-TITE joints are strong, very flexible and tight.

Write for our free trial offer.

HYDRAULIC DEVELOPMENT CORPORATION

MAIN SALES OFFICE - 50 CHURCH STREET, NEW YORK
GENERAL OFFICES AND WORKS - WEST MEDFORD STATION BOSTON, MASS.

OVER 25 YEARS WITHOUT A FAILURE

Position Wanted

Water Chemist—45 yrs. of age, married, 23 yrs. experience in water field including the chemical and bacteriological testing of water and plant supervision. Thirteen years in last position. Available immediately. Will go anywhere. Address "W. S.," Water Works & Sewerage, 155 East 44th St., New York City.

Decarbonator for Degasification

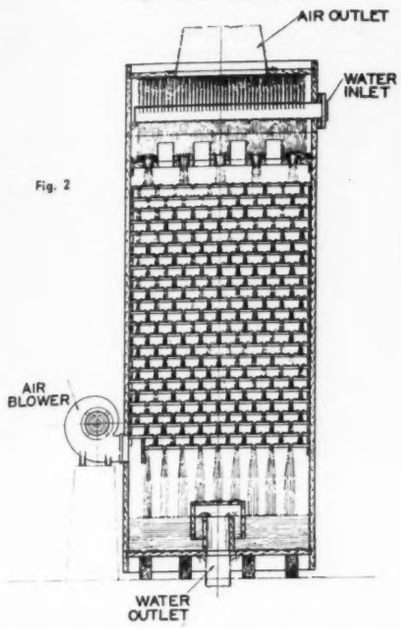


Fig. 2

● The Cochrane Degasifier has been developed primarily to meet the increasing demands of industrial and utility plants for trouble-free boiler feed water. However, it has a place also in the municipal field as a degasifying unit in corrosion control.

As a Decarbonator this unit is currently used to remove carbon dioxide from the effluent of carbonaceous hydrogen zeolite softeners and from boiler waters treated with acid. Where soluble iron and carbon dioxide are present in the natural water supply, as they are in many parts of the county, the Degasifier removes the dissolved carbon dioxide or hydrogen sulphide. It may also be employed as an aeration unit by operating the air blowing fan.

Details of construction and application are given in Publ. 2975 which may be had from Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia.

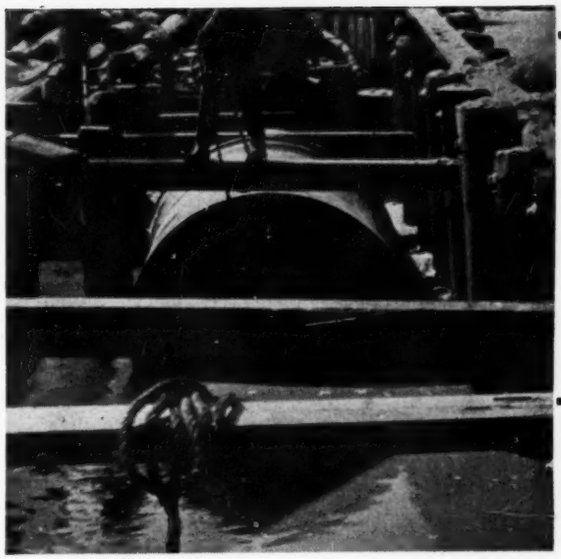
"Easyclean" Strainers for Pipe Lines

● Wright-Austin Co. of Detroit have developed the new "Easyclean" Strainer for installation in pipe lines conveying water, steam, air, oil or gas.

The "Easyclean" design is essentially an enlarged cylinder inserted in the line just as one would insert a nipple with union connections on both ends. The enlarged cylindrical chamber contains a metal cylinder of perforated sheet metal (brass, copper, etc.) having 400—1/32" openings per square inch. The annular space surrounding the screen serves as the sediment collecting chamber at the lowest point of which is a blow off.

The "Easyclean" assembly is available for pipe lines of ½" to 2" diameter. Their overall length is 3" to 10⅝" and diameter 2" to 4¾". The prices seem very reasonable.

For further details and illustrated literature, write Wright-Austin Co., 315 W. Woodbridge St., Detroit, Mich.



84" pipe—Spring Lake, N. J.

FLANGED PIPE
FLEXIBLE JOINT PIPE
BELL & SPIGOT PIPE
SPECIAL CASTINGS
SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

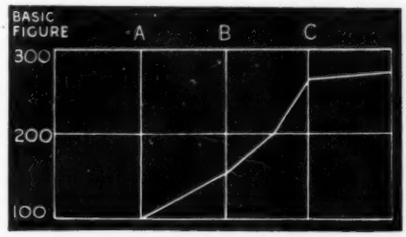
SIZES 2" TO 84"

Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.

75 Federal St., Boston



VACUUM FILTERING COSTS LOWERED

To ascertain which is more economical, a series of plant runs was conducted, using three different coagulants. Carefully kept records covered:

Weight of Wet Cake
Per Cent Solids
Pounds Dry Cake
Solutions Used in Inches
Pounds per Inch
Total Pounds Used (Anhydrous)
Per Cent Used to Dry Solids
Costs

. . . . and here is the record of Filter Yield:

Material	"A"	"B"	"C"
	7.53 lbs.	6.74 lbs.	5.38 lbs.

per square foot per hour

Setting cost of **ISCO FERRIC CHLORIDE** (Material "A") at 100—the cost of other materials proved to be:

Material "B" 151 Material "C" 254

ISCO FERRIC CHLORIDE cost
51% less than "B" 154% less than "C"

Doesn't this suggest that you should write at once for more information about

ISCO FERRIC CHLORIDE

INNIS, SPEIDEN & CO.
117 LIBERTY STREET, NEW YORK, N. Y.
Chicago Cleveland Boston
Philadelphia Gloversville, N. Y.

THE NATIONAL METHOD
BEFORE CLEANING
AFTER CLEANING

CLOGGED PIPES

Made Good as New

THE NATIONAL METHOD OF WATER MAIN CLEANING makes your old pipe practically as good as new. Every department is subject to loss through the ravages of time upon its distribution system. The cleaning out of this foreign matter inevitably leads to increased pressure and flow, improved health conditions, and lowered operating costs.

Our illustrated Booklet, "The Cleaning of Water Mains," will be sent upon request.

NATIONAL WATER MAIN CLEANING CO.
30 Church Street, New York, N. Y.

BRANCHES
115 Peterboro St., Boston, Mass.
910 William-Oliver Bldg., Atlanta, Ga.
7103 Dale Ave., St. Louis, Mo.
208 E. Forsyth St., Jacksonville, Fla.
3812 Castellar St., Omaha, Neb.
205 W. Wacker Drive, Chicago, Ill.
501 Howard St., San Francisco, Calif.
58 Pelham Ave., Toronto, Canada

LEADITE

The Pioneer Self-Caulking Material for C.I. Pipe

Another User Says:

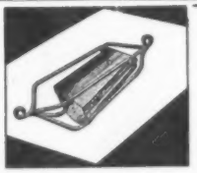
"WE HAVE LAID WITH LEADITE JOINTS"...

6" Mains	332,935 feet
8" Mains	260,902 feet
12" Mains	210,018 feet
16" Mains	55,688 feet
20" Mains	41,283 feet
24" Mains	5,949 feet
Total	906,775 Feet

THE LEADITE COMPANY

Girard Trust Co. Bldg.
Philadelphia, Pa.

No Caulking



COMPLETE SEWER CLEANING EQUIPMENT

If you need a sewer cleaning machine, sewer rods or sewer cleaning tools. don't fail to investigate our complete line before buying. Machines sold or leased. Sewer rods and hand tools sent on free trial.

Write for Catalog

W. H. STEWART

Syracuse, N. Y. P. O. Box 767 — Jacksonville, Fla. P. O. Box 581

779 Argyle Road, Windsor, Ont., Canada

The Meter-Master

RATE RECORDER FOR WATER METERS

Send For Literature

F. S. BRAINARD & CO.

246 Palm Street, Hartford, Conn.

WITH THE MANUFACTURERS

Sam Tolman Returns to Jeffrey

Sam L. Tolman

In Jeffrey Co.'s announcement that Sam L. Tolman has returned to their Sanitary Engineering Division in Columbus, to become Manager of Sales of this Division, there is a note of genuine elation which we can well understand.

Jeffrey's gain is New York City's loss, for Mr. Tolman was until May 1st Superintendent of New York's most important sewage treatment plant—that at Ward's Island. That such loss is keenly felt by the New York authorities is evidenced in a letter to Mr. Tolman, a copy of which was sent WATER WORKS AND SEWERAGE by Wellington Donaldson, Director of the Bureau of Sewage Disposal:

New York, N. Y.

Samuel L. Tolman
Jeffrey Manufacturing Co.
Columbus, Ohio

Dear Mr. Tolman:

I am sorry not to have had a chance to see you before you left for Columbus and I now express my appreciation for your willingness to defer your resignation.

Your services as Superintendent of the Wards Island Plant have been eminently satisfactory and it is with considerable regret on the part not only of myself but of Mr. Gould, Mr. Donaldson and other of your associates that you have found it to your advantage to seek employment elsewhere.

With best wishes for success in your new undertaking, I am

Very truly yours,
IRVING V. A. HUIE
Commissioner.

Mr. Tolman came out of M.I.T. and with the Chicago Sanitary District rose to the Superintendent's post at the District's North Side Plant. He went therefrom to the Jeffrey Co. and had much to do with development of sanitary equipment ("Floctrol," "Jigrit," etc.) when the New York City offer lured him back into the operating game. Certainly at Wards Island he did a splendid job and we feel that Jeffrey has played a trump card in "selling" Sam Tolman on the idea of coming back.

In the language of a certain New York-Hollywood columnist—Congratulations to You: Mr. and Mrs. Jeffrey!

R. D. Nichols, who has been devoting most of his time during the past year or so to Sanitary Development and Sales, returns to his former position as Manager of the Patent Department.

National Establishes Chicago Office

Jim Brown

Clinton Inglee, Pres. and Gen'l Mgr. of National Water Main Cleaning Co., announces the opening of a Central West Office in Chicago.

The new office will serve the States of Kentucky, Ohio, Illinois, Indiana and Michigan, with James R. Brown as Branch Manager.

Mr. Brown has been connected with "National" for many years with headquarters in Columbus, Ohio. The Chicago office is located at 205 Wacker Drive.

Chicago Bridge & Iron Expands Texas Offices

● On June 1st the Houston office of the Chicago Bridge & Iron Co. was moved into larger quarters at 918 Richmond Ave. The personnel of this office, previously restricted to sales work, will be augmented by the transfer of Mr. S. C. Hamilton from Birmingham to Houston, and by the opening of a new erection division office to handle the supervision of field work in the Southwest. W. T. Hudson will be in charge of the erection office.

The Dallas office of the Company has been moved to the Praetorian Building. The personnel of that office will be increased by the transfer of Mr. R. A. Williams from Chicago to Dallas.

Pardee Retires from Chlorinator Field

● Howard J. Pardee, president of The Pardee Engineering Co. of Long Island City, N. Y., chlorinator and ammoniator manufacturers for the past several years, has announced the discontinuance of his company.

To meet an obligation to his customers who have been friends and supporters, Mr. Pardee announced that arrangements have been made with the Wallace & Tiernan Co. to take over all tools and fixtures of his company, maintain an adequate stock of replacement parts, and provide field service for the reasonable life of all Pardee equipment now in use.

WANTED

Experienced, practical hydraulic engineer for Venezuela, able to install complete water works systems. Excellent opportunity for responsible graduate engineer.

The Star Drilling Machine Co.
Akron, Ohio

USED TRENCHER

P&H ladder-type in good condition. Equipped with Waukesha 55 h.p. gas engine. Digs 22" to 26" trench, 15' in depth. Can ship in 12 days. Reduced to $2,250 for quick sale. Write Box No. 60, Water Works & Sewerage, 330 South Wells Street, Chicago, Ill.

Max Wirtz Passes Founded Atlas Co. Almost 50 Years Ago. George Wirtz Succeeds to Presidency

Max F. Wirtz

Max F. Wirtz, founder and president of The Atlas Mineral Products Co. of Mertztown, Pa., passed away in his home in Allentown, Pa., on the 9th of May.

He was in his 71st year, but active up until only a few months before his death. In fact, he was stricken in California, where he had gone with the intent of locating a new plant to better serve the Far West.

In 1892, 48 years ago, he founded The Atlas Co., which he named "The House of Jointing Materials," and developed "Mineralead" for water main jointing and "G-K" Compound for making root-proof sewer joints. In the industrial field, for their acid proof masonry and tank linings Atlas early became favorably known.

Mr. Wirtz was first of all the "Gentleman" in everything that he did. His modesty, among other high qualities won for him a host of good friends and business acquaintances, built up through the years. His largest single order from the water works field was received shortly before his illness. He was a Mason and member of The Chemists' Club of long standing.

He is survived by his widow, three daughters, two sons, and fourteen grandchildren. The two sons, Arthur F. and George L. have long been active in the company, and now George succeeds to the presidency of Atlas. and Arthur succeeds George as Secretary and Treasurer.

125 "Chlor-O-Feeders" In a Single Order Constitutes Something of a Record

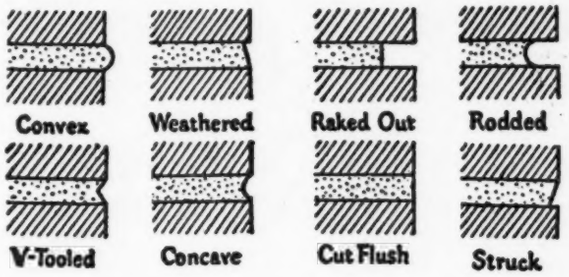
● *"What is a home without a Chlorinator?"* would seem to be the slogan of the Chicago real estate firm A. T. McIntosh Co., which has recently placed a single order with Proportioneers, Inc., for 125 of their Midget Chlor-O-Feeders.

The story is this: Every property owner in this new subdivision of "country estateletts" is to have his individual well water supply and each well is being equipped with its own "Little Red Pump," to effectively sterilize the supplies automatically through belt connection to the pump drive.

(This story brings to mind an accusation flung at the writer during his enthusiastic service with The Chlorine Institute. The accusation was that "Linn Enslow would soon have a chlorinator in every bathroom." Well, it's getting closer and closer all the time. With these Little Red Pumps —who knows?—L.H.E.)

TYPES OF MORTAR JOINTS

Recommended — Not so good



DRY-JOINT

waterproof pointing mortar stops leaks in all masonry joints. It thoroughly seals shrinkage cracks and defective cement mortar. It bonds perfectly, is easy to apply and makes a neat job. Our booklet, "Leaky Brick Walls and How to Prevent Them" will interest you. Send for your copy.

SHERWOOD WATERPROOFING CORPORATION
53 Park Place — Dept. B. — New York City

Prevent wear and cutting of rods, plungers, shafts and valve stems by using

MABBS RAWHIDE PACKING

In Your Water Works and Sewage Plants

IT LASTS LONGER — *Is Anti-Frictional, Saves Power, Labor and Repairs. Will prove the cheapest packing that can be bought.*

Trade Mark Reg. U. S. Pat. Off.

Mabbs Hydraulic Packing Co.
Incorporated 1892
431 S. Dearborn St., Chicago, U. S. A.

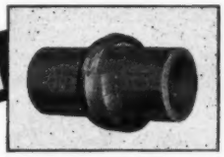
EDSON'S NEW HAND PUMP

Smallest Diaphragm Pump Made, 2" Suction Open Discharge. Capacity 1400 G.P.H. Weight 50 lbs.

THE EDSON CORP'N
49 "D" Street
So. Boston, Mass.
NEW YORK: 142 Ashland Pl., Brooklyn
CHICAGO: 1061 Peoples Gas Building

Catalog "T" Gives Full Data, Also Edson Hand and Power Pumps, Suction Hose and Pump Accessories

WESTON



GASKET AND FORM
The Perfected Method for Making SEWER PIPE JOINTS OF CEMENT

- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

L. A. WESTON — Adams, Mass.

ARROWHEAD Grating and Treads

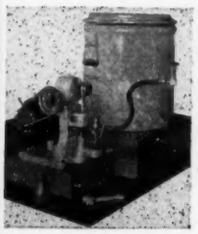
Engineers' Handbook sent on request

ARROWHEAD IRON WORKS
431 W. 5th Street
Kansas City, Mo.

When you think of
ALUM
... think of
ACTIVATED

ACTIVATED ALUM CORPORATION
Curtis Bay — Baltimore, Maryland

WILSON CHEMICAL FEEDER



Outstanding features are quick feed adjustment, visible valves, flexible cylinders; feeds against 150-lb. pressure, and proof against corrosive chemicals.

Motor driven, positive displacement, pump type feeder. It is illustrated as a constant rate feeder though also furnished as Type MD-H with fluid meter control, and when so arranged is a measure-to-measure proportioning feeder.

This is a sturdy, dependable heavy duty feeder.

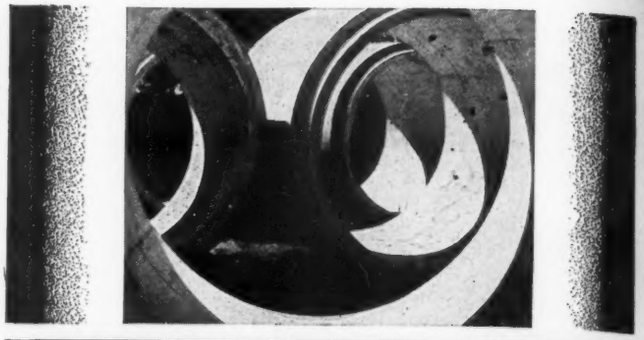
Write for bulletin

Wilson Chemical Feeders, Inc.
BUFFALO, NEW YORK

INQUIRIES INVITED on all Problems of Water Treatment

Whether your problem of water rectification is large or small, we have a form of equipment to serve your needs. We manufacture and install equipment for Gravity Filtration and Softening Plants; Pressure Filters and Zeolite Softeners; Swimming Pool Recirculating Appliances; and Water Treatment Units of all types.

ROBERTS FILTER MFG. CO.
607 COLUMBIA AVE DARBY, PA.



LOCK JOINT REINFORCED CONCRETE PIPE
LOCK JOINT PIPE CO. Established 1905 AMPERE N. J.
PRESSURE • SUBAQUEOUS • SEWER • CULVERT

INSTALLATIONS WORLD WIDE

VALVES COMPLETE EQUIPMENT FOR WATER WORKS FILTRATION AND SEWAGE DISPOSAL PLANTS
LATEST "COREY TYPE" HYDRANTS

LARGEST CITY TO SMALLEST VILLAGE

Plant: Oskaloosa Iowa

Write for Catalogue and Information
IOWA VALVE CO.
General Offices: Hubbell Bldg., Des Moines, Iowa

Complete equipment for Filtration Softening and all other kinds of

Water Purification PLANTS

Dry Chemical Feeders
Swimming Pool Filters

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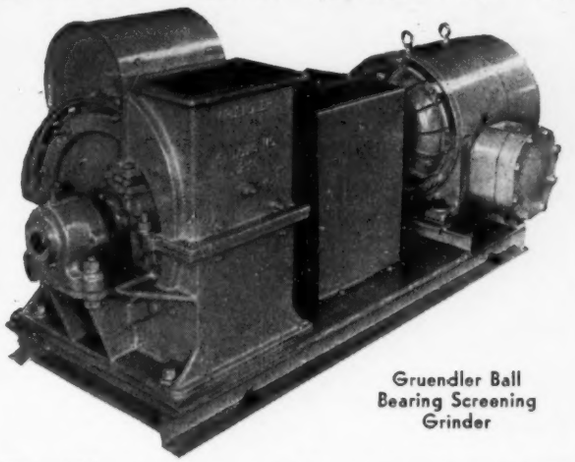

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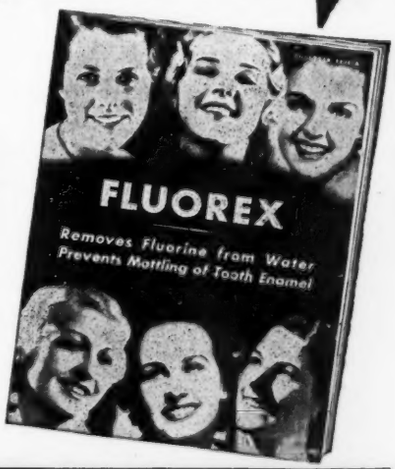

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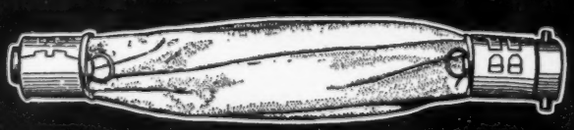

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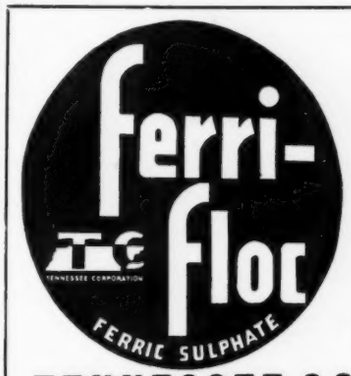

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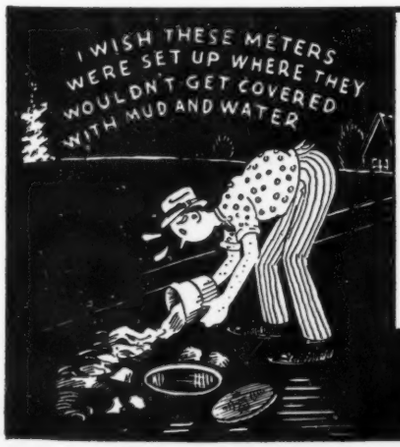

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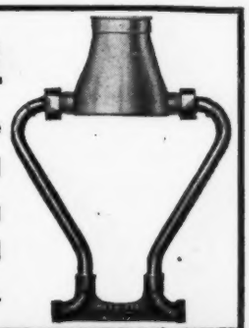

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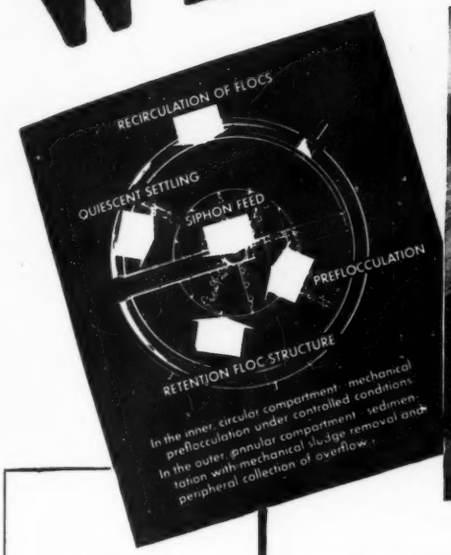
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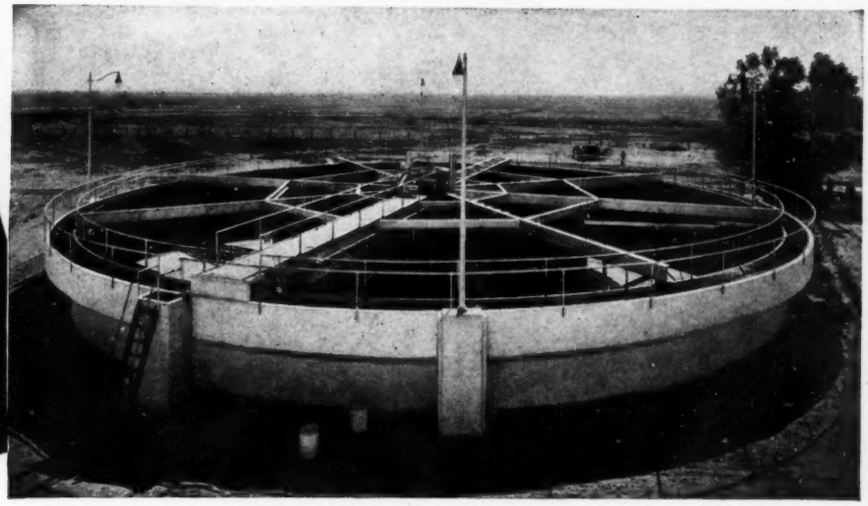

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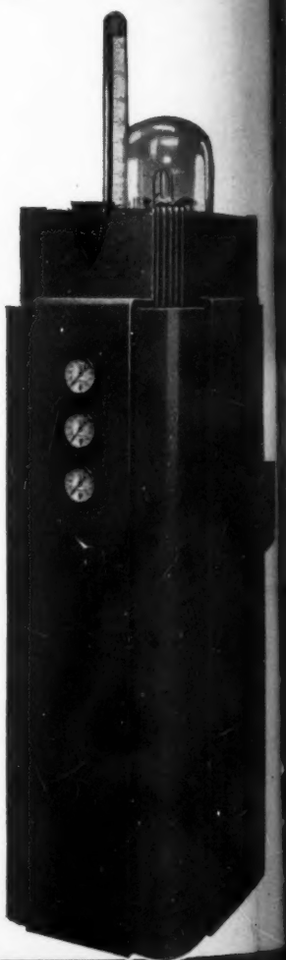

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